

A WHITE PAPER

**AN ASSAY
OF ENVIRONMENTAL CONDITIONS
IN GUILFORD COUNTY
WITH
RECOMMENDATIONS TO CANDIDATES
FOR PUBLIC OFFICE**

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Enclosed please find a "White Paper", a report of an examination of environmental conditions in Guilford County. This study was carried out and reviewed by a group of citizens who live in Guilford County.

We made this effort because we relate to our surroundings. We not only think that this particular geographic area is a beautiful and very comfortable location in which to live, but also know that the quality of our environment determines the quality of our lives.

However, we have seen things that indicate that the quality of our Guilford County environment is rapidly being lowered. We are very concerned about this and wish to inform others about it.

We attempted to get at root causes for this degradation, using objective means in doing so, in order to propose specific ways to stop it.

This paper, in essence, describes and defines unsatisfactory and dangerous conditions in Guilford County and presents recommendations for actions to eliminate them.

We have found that the extent of environmental degradation is so great that the powers and services of our government on all levels will be required to cope with it.

For this reason, we have addressed ourselves to our future representatives for actions which, we feel, will be a necessary step toward maintaining the beauty and healthfulness of Guilford County

These recommendations are rational, they were tailored to call for practical actions; these actions are necessary to respond effectively to meet new critical problems of a changing environment in a changed society.

We hope candidates to elective office will express themselves about this white paper. We hope that they will perceive that this report is a sincere and earnest statement of what many of their constituents want and all of us need.

It is an apolitical document; the issues of human health, contentment, and even survival, are too great for anything less than that.

Sincerely yours,

James R. Rees
James Rees and the ad hoc
citizens group

Introduction

This paper is a report concerned with environmental conditions in Guilford County. It has been written and reviewed by scientists using the methods and techniques of scientific enquiry. It is composed to be easily read and understood, to be specific and concrete. It is presented to be informative and useful primarily to candidates for public elective office. To this end, certain recommendations are made by the authors for the consideration of these candidates. These recommendations are the result of careful study by the authors who hope that the candidates may view them as guide-lines to their official actions as public representatives.

This paper is an expression of the strong concern which the authors and reviewers have over the on-going destruction of the environment. They understand the ultimate consequences of this continuing damage. Therefore, they ask that all citizens study the content of this report in light of their own welfare and right to a healthful and pleasing environment.

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The Population of Guilford County

Questions about the size and composition of human populations have had a continuing fascination for mankind. In part this seems to be an expression of idle curiosity. But there are serious aspects to this interest as well. Businessmen, educators, and political leaders, among others, engage in many activities which depend upon the nature of the population they serve. Believing that this interest might be aided, what follows is a brief discussion of some of the major characteristics of the population of Guilford County, North Carolina.

In 1960 Guilford was the second most populous county in the state of North Carolina. The 1960 Census of the United States reported Guilford County with a population of 246,520. This figure represented a population 29% larger than that which had resided in the county in 1950 and it was a 60% increase over the 1940 figure. To place these findings in perspective, the state of North Carolina increased in population 12% between 1940 and 1960. The same measures for the United States as a whole were 18% and 36% respectively. At this writing the results of the 1970 Census are not available. However, using estimates made by the Guilford County Planning Department for 1970, we find that the approximate increase since 1960 is 43%. If these estimates are, in essence, substantiated by the Census Reports, the county is continuing the trend of the last thirty years and growing more rapidly than either the state or the nation.

Guilford County occupies a rather unusual status in that it contains two distinct urban areas, Greensboro and High Point. The population of Greensboro had increased by 61% in the decade since 1950 to a total of 119,574. In the same period, High Point acquired a population of 62,063, a 55% increase over that city's 1950 total. The combined urban populations of 181,637 made the county approximately three-quarters urban. In this respect Guilford County followed the national population which was also about three-quarters urban.

The national census in 1960 revealed a continuing decline in the portion of males. The sex ratio for the nation was 97 males for every 100 females in the population. There were variations, of course, in the different regions and states, but North Carolina was similar to the national pattern with a sex ratio of 97 males per 100 females. However, Guilford County departed from this pattern with only 92 males for each 100 females. The higher portion of females in the population was reflected in the labor force of the county which was 61% male. This contrasted with labor forces which were 64% male in the state and 67% male in the nation. When the findings for the sex ratio are broken down on the basis of race, Guilford County again has a distinctive position. The sex ratio for whites in the nation was 97 while that of the Negro population was 93. In North Carolina the sex ratio was 98 for whites and 94 for Negroes. In the county the white segment of the population had a sex ratio of 92 compared with the 94 of the Negro portion. While the national sex ratio is more likely the result of differing death rates between males and females and reflects the longer life expectancy for females, this explanation does not hold for

the different geographic regions of the nation. Guilford County's rather low sex ratio is more likely the consequence of differential migration patterns. That is, men are somewhat more likely to remain in rural areas and be engaged in agricultural activities while females seem inclined to move from small towns and rural farms to urban centers where they view the future as more promising.

When the age characteristics of the Guilford County population are examined, they are found to lie between the national and the state figures. In the United States in 1960 the median age of the population was 29.5 years. North Carolina's median age was 25.5 years. Guilford County had a figure of 27 years for its median age. Closely related to the finding on median age is the size of the dependent populations, young and old. The following small table suggests some of the differences in proportions of the young, the aged, and productive adults.

AGE Group	Nation	North Carolina	Guilford County
0 thru 14	31%	33%	32%
15 thru 64	60%	60%	62%
65 and over	9%	7%	6%

In the consideration of these figures we, of course, have the mixed influence of differential reproductive behavior and migration consequences. The South has long been a region with a relatively high birth rate and this seems to be reflected in the somewhat higher portion of young in the figures for the State of North Carolina. Guilford County's higher percentage in the productive adult years is probably a consequence of a lower birth rate in the urban areas. This is a small, but probably significant difference for the County. By having a smaller dependent population plus the slightly larger population of productive adults, the residents of Guilford County are spared some of the burdens of supporting a large dependent population.

The adult population of Guilford County (those over age 24) had a median of 10.4 school years completed. At the same time the median number of school years completed in the state was 8.9. The national figure was 10.6. Forty per cent of Guilford County residents had finished high school while only 32% of the population of the state had done so. For the nation as a whole, 41% had graduated from high school. Thus, Guilford is slightly below the level of the nation in terms of educational achievement, but well above the level found in the state as a whole. This finding also demonstrates the consequence of migration patterns. Those with education go to the city to seek their fortune. Another factor influencing this finding is the greater emphasis placed on education in the urban environment as well as the availability of more and closer schools.

Guilford County has an area of 651 square miles. With 246,520 people in 1960, there was a density of 379 per square mile. Needless to say, this population was not equally distributed. The City of Greensboro occupied 48.6 square miles and with its 1960 population of 119,574 had a density of 2,460 per square mile. High point occupied 30.3 square miles in 1960 and had a population of 62,063. Thus, High Point had a density of 2,048 per square mile. Outside of the area occupied by the cities of Greensboro and High Point there were 572.1 square miles. Of the 246,520 who lived in Guilford County, 181,637 lived in Greensboro or High Point. This left 64,883 in the county outside of these major urban concentrations. This resulted in a density for the county of 113 per square mile. (computed from City, County, p. 546)

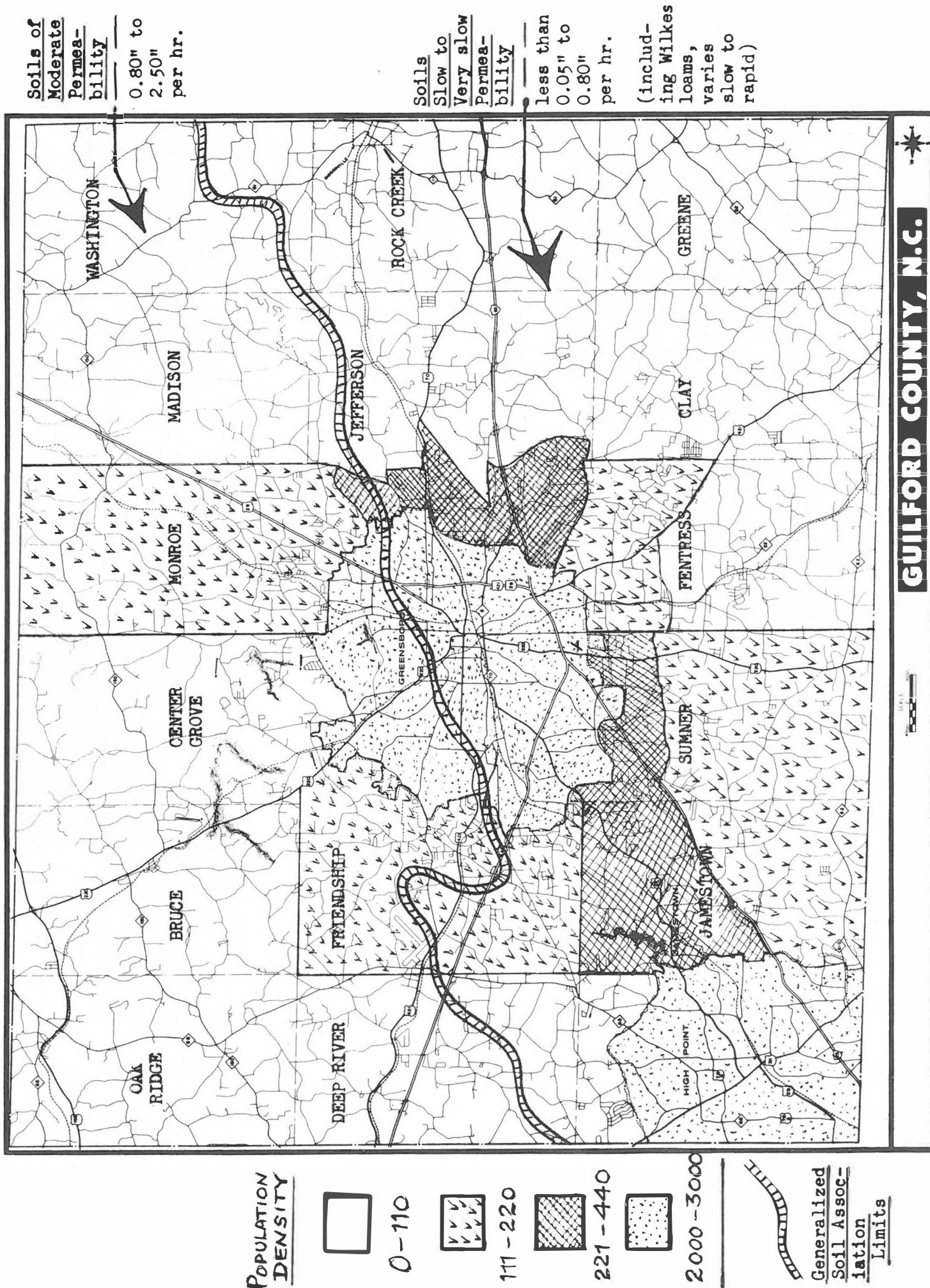
The difference between the density of the built-up areas of the cities and the less densely settled rural area means that the continued growth of the cities will be accomplished by settling areas now rural with higher density populations and incorporating them into the cities. The following table indicates the growth of rural townships. The first column is the growth from 1940 to 1950. The second column is the growth from 1950 to 1960. The third column is the growth from 1960 to the estimated population of 1968.

Township	1940 to 1950 (percent)	1950 to 1960 (percent)	1960 to 1968 (percent)
Bruce	37%	21%	10%
Center Grove	2%	93%	42%
Clay	15%	12%	9%
Deep River	30%	54%	5%
Fentress	41%	42%	26%
Friendship	27%	77%	73%
Greene	15%	6%	6%
Jamestown	20%	41%	14%
Jefferson	17%	165%	23%
Madison	11%	4%	6%
Monroe	30%	116%	31%
Oak Ridge	5%	21%	12%
Rock Creek	4%	5%	-1%
Sumner	41%	43%	30%
Washington	17%	16%	11%

Examining the table we see the tendency of Townships on the North and West of Greensboro to grow and absorb the urban overflow. Thus, as the city grows and expands its boundaries, more and more rural space is taken into the urban complex. If we imagine some indefinite date in the

future when Guilford County might hold a population with the average density of Greensboro in 1960, the county would have 1,600,000 inhabitants! There seems no reason now, to take such a mind-boggling statistic seriously. However, the problems that such a population would cause do give one pause. The continued displacement of rural land use patterns will remain a source of difficulties. The spread of urban population densities into an evergrowing area will produce other and increasingly complex problems. For example, larger volumes of traffic will create the pressure for expenditures for expressways, increased numbers of accidents, and more serious air pollution. The demand for the amenities of urban life will force the extension of utility services and tax the available resources of power and water. The spread of suburban life styles will necessitate the construction of more shopping centers, churches, and schools. Waste disposal services will require expansion and improvement if safe levels of health and sanitation are to be maintained.

While this consideration of some of the traits and trends of the population of Guilford County has been brief, it does indicate the mixed blessings which exist. To sustain a healthy, well-educated, and prosperous community is a task which is going to require great ability, careful planning and foresight. The appearance of the 1970 Census will give more recent data upon which to base this planning. When this information becomes available, those who are interested in the future of Guilford County should give it careful study.



Compatibility of Land Uses in Guilford County: Dominant Environmental Condition

The needs and desires of an increasing population exert pressures upon the more sparsely inhabited areas of Guilford County. Demands for changing current land use are on-going as requirements to fulfill these needs and wants of an increasing number of people continue to mount. The rural portion of the County, generally agricultural land, is being reduced for other uses. Three uses require extensive space beyond urban limits, and because this room is limited, given areas must accommodate multi-usage. These uses are: (1) residences, together with needed roads, streets, and institutional structures (2) catchments of precipitation for water supplies, including the space covered by the impounded water of reservoirs (3) parks, recreational areas, and undeveloped wilderness areas.

Where the same geographic area must accommodate a number of uses, the uses must be compatible; i.e., any one use cannot be permitted to render the area unsuitable for the other uses. This compulsory sharing of space harmoniously may be attained by (1) careful selection of uses which are adapted to the physical conditions of the open space (2) proper installation of facilities required for the satisfactory functioning of the given use (3) proper management and maintenance of the given use.

RESIDENTIAL DEVELOPMENT BEYOND SEWER AND WATER LINES

Approximately one-half of Guilford County contains soils whose physical properties inhibit, to varying degrees of severity, substantial construction of residential buildings (including driveways, walks, patios, etc.) and the satisfactory functioning of the facilities service these residences.

Generally, these soils occupy the southern half of Guilford County delimited by a line that approximately follows U.S. Interstate 40 from the Forsyth County line to **Clifton Road**, crosses Greensboro diagonally to Huffine Mill Road, follows Huffine Mill Road to N. C. Route 61 to Guilford County Road 2735 eastward to the Alamance County line.

Although there are areas of well-drained soils within this portion of the County, these are minor in extent relative to the soils which exhibit slow to very slow permeability characteristics impeding the movement of liquids through them (less than 0.05" to 0.80" per 60 minutes).

Other areas occurring throughout Guilford County are unsuitable for residential development because of the topography where slopes occur over 15 per cent, and because they are flood plains subject to seasonal inundation of water. The steep slopes as well as the flood plains generally follow the stream and river courses crossing the County.

Legal Requirements

The "Zoning Ordinance, Guilford County, North Carolina" passed in March 2, 1964 by the Board of County Commissioners of Guilford County (together with amendments current to 3/1/69) cites legal regulations controlling land uses

within defined zones of Guilford County. Article V "Schedule of District Regulations," Sections 5-1, 5-1A, 5-2, 5-2A, and 5-3 deal with residential developments which do not have access to water and sewer lines. These developments would be adjacent to or in the proximity of urban developments served by these utilities or farther away in areas considered and defined as being principally agricultural. Article VI "Administration and Enforcement", Section 6-5 of the same ordinance states: "The Inspections Director shall not issue a building permit for any building for which a Guilford County Health Department permit approving the installation of a sewage disposal system is required until such permit has been issued by the Guilford County Health Department. Such permit shall accompany the application for a building permit and certificate of occupancy."

"Subdivision Ordinance, Guilford County, North Carolina" passed by the Board of County Commissioners of Guilford County and in effect on and after May 17, 1965 states regulations governing the "procedures and standards for the development and subdivision of real property for residential, industrial, institutional, or commercial purposes..." Section 8. Minimum Standards Of Design, Item B. Lot Standards, Sub-item 3. Minimum Lot Sizes, (b) states: Residential lots not served by a public sewage system will be approved only if they are at least twenty thousand (20,000) square feet in area and have been certified in writing by the County Health Department to be of appropriate size and layout for on-site sewage disposal."

Additionally, Section 7. General Requirements, V. Restrictions on the Subdivision for Residential Purposes of Land Subject to Flooding states that no proposed building lot shown that is wholly subject to flooding shall be approved but makes the exception that a lot may be partially flooded if the lowest usable and functionable part of the structure is not below a line two feet above a 20 year flood.

Loans for residential construction are made directly by and/or insured by the Veterans Administration, the Farmers Home Administration, and the Federal Housing Administration providing the loanee is eligible and the construction meets certain specifications.

Item 30. Sewage Disposal of Form FHA 424-2 (Rev. 9-21-64), used by the Farmers Home Administration of the U. S. Department of Agriculture, presents a series of blank spaces to be filled in with information pertaining to septic tank sewage disposal construction and installation. Percolation rates of the soil of a proposed filter field are not required here, however. "General" instructions state "Each item of material and equipment shall equal or exceed that described or indicated. All work shall be performed in a workmanlike manner and in accordance with the best practice." There are no instructions as to what parties are to make these determinations and how the measurements are to be made, although a space is provided for the applicant's name and for the name of the County Supervisor approving. A space is also provided for the name of a party who prepared the form, but does not specify by occupational title or otherwise the qualifications of the party who prepared the form (ostensibly made the determinations).

The Federal Housing Administration has codified detailed instructions and specifications that must be met before approval of the application for the loan is made. This official literature is much more exhausting in describing

all requirements of establishing a satisfactory residence than is the Farmers Home Administration form, but in both cases (all cases) the single factor which restricts all home construction beyond sewer lines, where septic tank disposal systems are used, is the capability of the soil to absorb effluent from the septic tanks to a degree that the hazard to health is eliminated as well as esthetic values are respected. This in no way minimizes the importance of the relationship of soil properties to the many other aspects of building construction and maintenance and yard establishment and maintenance, but soil permeability, outside of the most unusual circumstances, becomes the sole factor which governs ALL certification.

Procedures on how to make "percolation tests" to determine the degree of soil permeability necessary for proper absorption are stated explicitly in the Federal Housing Administration regulations. Included are standards of the rate of water absorption into the soil. These procedures and standards agree, with some minor variations, to those required by the Guilford County Health Department. These regulations of the Federal agency are consonant with the County Health regulations. If regulations of local health departments have higher standards, Section 1101-4 "Codes and Regulations" of the FHA specifications state: "The minimum standards required herein shall not be construed as removing the necessity for compliance with any regulations established by the health authority having jurisdiction when such regulations provide for higher standards than contained herein. Any method for individual water supply or sewage disposal contained herein which is not permitted by a State or local health department shall not be used. Acceptable evidence of approval by the local health authority of each completed system will be required in all cases."

In accordance with this section which defers regulatory jurisdiction to the Guilford County Health Department, FHA Form 2084c, VA Form 26-1888 (Rev. 1/60) entitled "Subdivision Sewage Disposal Report" is a record form upon which the results of percolation tests are entered and submitted to the Guilford County Health Department for their approval of the suitability of the soils of a tract for a septic tank sewage disposal system. Form "N.C. Form 118 (Revised June 12, 1969) Proposed Installation of Individual Sewage-Disposal and/or Supply System" is used by the Federal Housing Administration for single units. It also defers to the Guilford County Health Department for prime approval.

Section 2, item E of the "Regulations Governing Design, Construction, Installation, Cleaning, Repairing, and Use of Septic Tank Systems in Guilford County (ordained by the Guilford County Board of Health) states: "The health officer shall deny a permit for installation of a septic tank system where the type of soil, the terrain, the results of a percolation test, or the size of a lot indicates that said lot is not suitable for such installation and may endanger the public health." Section 5 of this ordinance presents data for determining field requirement from percolation tests. These data indicate that if the average time for water in the test hole to fall one inch is over 60 minutes, the soil is unsuitable except for special design with seepage pits. This minimum rate is consistent with the minimum rate of absorption set by the standards of the Federal Housing Administration.

Our investigation of the legal requirements regulating the construction of residential buildings without access to water and sewer lines points

up the following facts:

1. The regulatory agency with prime responsibility for certifying all construction of dwellings not accessible to water and sewer lines is the Division of Environmental Health of the Guilford County Health Department.

This Division is staffed by a Director and four Sanitaricians who make the field inspections. Before any construction requiring a septic sewage disposal system is permitted, personnel of this division must approve, primarily by means of the percolation test, the capability of the soil to absorb liquid septic effluent to a degree that physical health is not threatened nor the area be esthetically displeasing. Lending agencies will not loan money to parties for building nor will Federal agencies lend or insure loans until the Sanitaricians of the Division of Environmental Health certify that the tract or lot upon which the dwellings (or dwelling) is to be constructed has soils that will adequately contain and disperse the liquid emitted from a septic tank.

2. The determination of this soil characteristic becomes the paramount factor limiting construction of residences beyond sewer lines. The procedures leading to this determination including the validity and reliability of the percolation test itself becomes the essential issue.
3. The use of the "percolation test" as a means intended to measure the capability of the soil material to contain and disperse the liquid emissions from septic tanks as well as the testing and inspection procedures appertaining are arbitrary determinations of the Division of Environmental Health.

There are no stated legal specifications requiring the personnel of this Division to measure the permeability of soil by use of the percolation test nor controlling the manner in which it is carried out.

The percolation test used to determine a suitable permeability of the soil in Guilford County has been adopted from the book, Municipal and Rural Sanitation, by Victor M. Ehlers, C. E., McGraw-Hill Book Company, Inc.

Procedures Followed for Acquiring Certification to Build a Residence Not Accessible to Water and Sewer Service Lines in Guilford County.

Note: The procedures described in the following statements are essentially those that are required to obtain certification of a tract of land or lot to be suitable for residential construction using on-site septic tank sewage disposal systems. Assuming that most developers or builders borrow money from various lending agencies to meet the cost of construction, the procedures are outlined to the point of obtaining this loan. Special literature informing prospective builders and developers of the procedures they should follow are readily

available from the Guilford County Planning Department. Included in this brief outline, however, are the procedures for making the percolation tests intended to determine the capability of the soil of the land area to absorb adequately the effluent of septic tank systems. The steps of the procedure presented here follow a logical sequence. Unfortunately, based upon testimony given by workers in the various regulatory agencies involved, many parties have not followed this sequence with the result that many unnecessary misunderstandings have ensued. The "Developers Manual" of the Guilford County Planning Board cautions "Before spending a great deal of money laying out lots and making improvements, it would be well to know that each lot is going to be usable. If sewage is to be disposed by septic tank and drain field, be reasonably sure that the soil is suitable." This caution might apply better to an earlier transaction, that of buying the land originally.

General Procedures

1. Clearance with the Guilford County Planning Department to comply with Zoning and Building regulations.
2. Clearance with the Division of Environmental Health of the Guilford County Health Department certifying that the soil is determined to be suitable, as measured primarily by the percolation test, for a septic tank disposal system. All forms and permits required by all and any lending agency should be signed for approval of this factor.
3. Follow through transactions with lending agencies, real estate agents, builders, etc.

Procedures for Making Percolation Tests

For efficient use of the time of the four field inspectors employed by the Division of Environmental Health, the prospective home owner, or builder, or developer is asked to perform (or have performed for him) certain tasks prior to the on-site inspection and determination by the field men. A simple set of directions entitled "Directions for Percolation Test" is given the interested party upon his request. Along with a simple sketch giving the dimensions of a test hole, is this information:

1. Call the Health Department and make arrangements to have the test performed.
2. Dig test hole 30" deep and 12" wide. Rough-up inside walls.
3. Place 2 nails in the test hole. One 6" from the bottom and one 10" from the bottom.
4. Put 10" of water in test hole 12 hours before test is to be accomplished.
5. Leave one (1) - 5 gallon can of water beside each test hole.
6. Use only clean cans and water, do not use cans that have contained any type of petroleum products.

These are instructions for one test hole; as a matter of practice, at least two holes per lot are required by the inspectors. (Depending upon the zoning regulations, these lot sizes can vary from 43,560 square feet or one acre, to 40,000 square feet, to 20,000 square feet.) The number of test holes is deemed sufficient to be representative of the soil conditions of the lot as a whole; however, no instructions are given the prospective builder as to where the holes are to be placed (aside from frontage requirements of zoning regulations). These tests can run at any time during any season of the year.

The prospective builder may or may not be present when the field inspector runs the test. This consists of pouring the water into the hole to the depth of the top nail, 10" above the bottom of the hole, and marking the time. If the soil is slowly permeable, a lapse time of one hour must be allowed to determine the minimum permissible absorption rate (1" per 60 minutes lowering of the water). This would be for one test hole. Due to the press of business many times the field inspector moves on to other areas, leaving the test holes unattended, returning toward the end of a sixty minute period to measure the distance the water has lowered from the top nail. This rate of absorption is recorded by the field inspector (Sanitarian) upon an appropriate form together with other observations such as, for example, a gradient of slope, and soil type observed from the surface. Where it seems possible to make reasonable modifications of the construction of the septic tank system to get over-all adequate absorption where borderline cases occur, the certification of the lot is given with the provision that these modifications be followed. The prevailing attitude of the personnel of the Division of Environmental Health is to cooperate as fully as it is possible to do so with the builder or developer in permitting him to take advantage of his investment. Due to a number of variables that effect the rate of absorption of the water in any particular test hole ---variables that are not measured or recorded---approval of the site for a septic tank system cannot be made upon a totally objective evaluation. The field inspector must use his judgment in certain cases relying upon his personal experiences. Certification of the lot to be suitable for a septic tank disposal system is based upon the above procedures and tests.

The Effects of Malfunctioning Septic Tank Sewage Disposal Systems

The basic reasons for the careful treatment of human excreta by means of a septic tank and drainage field system, where this is required, is to keep possible disease organisms which reside in the intestinal tracts of sick or unhealthy persons from being carried by the effluent to infect other healthy individuals. Nearly as important is that odors and sight of this material is offensive to the senses. The bacterial action within the septic tank reduces much of the solid excrement to liquid which flows out through the tile drainage lines to be absorbed by the soil of the filter (or nitrification) field. Soil micro-organisms and exposure destroy harmful bacteria which might be present in this effluent. If the disposal system does not function properly because impermeable soil conditions exist, the effluent may surface, move laterally to flow out in nearby drainage ditches, or seep into dug wells. The danger of infection by direct contact or by drinking contaminated water is present. Attendant unpleasing odors accompany this undesirable action.

Where a number of residences are involved with inadequate septic tank systems, there is a very real threat of widespread contamination and epidemic sickness. During and following prolonged periods of heavy precipitation upon soils which are very slowly permeable, the soil being used as a filter field becomes saturated, and the effluent rises to the surface or moves to adjacent open drainage ditches. Uncontrolled or improperly regulated use of the septic tank disposal system for treating domestic sewage from large numbers of homes occupying a limited space poses a real danger to public health. Rapid and far-reaching communication of diseases from contaminated surface waters impounded for recreational activities or for domestic water needs can result.

Three sections of Guilford County which have had difficulties with the proper disposal of sewage by means of the septic tank system are: the Guilford Hills development, the Sedgefield area, and the area in the southeast quadrant of Greensboro. The Archdale-Trinity area immediately south of High Point in Randolph County has experienced contaminated wells. These locations have gained public attention; other "significant areas of septic tank pollution" are indicated on Page 12 of the "Land Use Plan" published in 1966 by the Guilford County Planning Board.

Deficiencies in Regulation of Residential Development Beyond Sewer and Water Lines

1. Reliability of Percolation Test Results:

To fulfill the basic purposes for the use of a septic tank sewage disposal system; i.e., to protect the health and sensibilities of the inhabitants of any given area where they are used, the disposal system must function properly continuously following installation both during periods when natural conditions are least favorable to the disposal process as well as when they enhance the process.

This necessary continuous functioning of the disposal system which uses the soil mass as an absorption or filter field for septic effluent depends directly upon the properties of the soil, the responses which the soil makes to increments of water or other liquids to it, and climatic conditions; principally amounts and distribution of rainfall.

The soils of Guilford County are highly variable. Principally because of the consistency and structure of the clay substratum portion of a large majority of these soils, the response to the internal movement of liquids through them differs radically. Also seasonal amounts of precipitation falling upon the land area of the County varies substantially. The resultant condition of the interaction of these natural phenomena is that there are periods when certain soils become readily saturated and remain so for long periods of time, or, conversely, are extremely dry during other interims of time. The clay of some soils is highly plastic and expands or contracts respectively to increments or deletion of water. Prolonged addition of water to these soils quickly saturates them. Because of these same characteristics, during periods of little rainfall (and high evapo-transpiration), these

soils shrink leaving fissures and other interstices throughout the soil mass.

The procedure presently followed to determine soil permeability permits percolation tests to be carried out anytime during the year. In the attempt to simulate the "saturated" conditions of the body of the soil into which the effluent will drain, County Sanitarians require "prewetting" of the test hole before additional water is timed. Prewetting entails keeping water in the test hole for a period of 12 hours before the rate of drainage of additional water is determined.

Essentially, this is soaking the soil within the immediate vicinity of the test hole. Although this is meant to represent a saturated condition of the entire soil mass (or even that portion of the soil into which effluent will pass), it is very doubtful that it does so. Water movements in a large mass of soil which is saturated by heavy amounts of rain are different from a temporarily saturated localized area in what may well be (and is during periods of drought) very dry soil surrounding it. Increments of liquid (effluent) to a saturated soil would not tend to move gravitationally or even slowly in a lateral direction but, instead, would tend to rise to the surface or readily follow clay layers to open cuts.

Consequently, this prewetting procedure is not a reliable means to induce a condition simulating the actual conditions of naturally saturated soil. This procedure of testing does not adequately insure that a septic tank sewage disposal system will fulfill the purposes intended.

2. Representation of Percolation Test Holes:

Because of the variability of the soils in Guilford County, within the areal dimensions of 20,000 square feet (allowable minimum lot size) it is highly likely that two, or even more, types of soil with highly contrasting properties may occur. Two adjoining soils within this area may possess properties that effect permeability to opposing extreme degrees.

Present methods for locating a portion of the lot containing soils suitable for a filter field require that two percolation test holes be dug somewhere in the lot (discounting area set aside in compliance with the Zoning Ordinance). The prospective builder or developer is left with the responsibility of locating and digging and preparing these holes for the tests. He is required to record upon an engineering topographic map, showing principally the gradient of the landscape as the major natural feature delineated, the locations of these two holes to aid field inspectors in finding them when he is not present.

If the soil of the lot was uniform, or nearly so, and possessed similar properties throughout their internal structure, two

percolation test holes anywhere upon the lot would be a valid sample representing the soil conditions of the entire lot. However, the variability of the soil poses a different situation. Two holes selected with none or very little guidance (which, say, might be obtained from a soil survey map of the area), are quite likely to be very unrepresentative of the soils of the given area. This circumstance is aggravated when a party unfamiliar with the soil identification, soil characteristics, and soil responses is left to select the locations for the test holes.

Improper location of the percolation test holes relative to the fact that variable soils may be present in the lot area may lead to immediate financial loss by the developer or builder, ultimate financial loss to the home-buyer who may have to correct the difficulties of an improperly placed septic tank system at a future time, or endanger community health if an improperly installed system fails to function adequately.

3 Follow-up Testing to Determine Effectiveness of Septic Tank Sewage Disposal Systems:

The existing pattern of residential building beyond the sewer and water lines is that more structures are erected in groups upon limited space than as single units upon land zoned agriculturally. This means a greater concentration of septic tank systems and people upon defined land areas. Because of the need for additional housing for an increasing population in Guilford County, this pattern of building will be maintained. As a consequence, the potential for serious contamination of surface waters by disease bacteria will increase. And an even greater potential exists where groups of residences are constructed upon areas which have generally slowly permeable soils.

Because presently there are no systematic "follow-up" or "post-installation" tests of waters draining from the watersheds (sub-watersheds) upon which housing developments have been established, there is no check to determine the reliability of the percolation tests. In essence, presently there are no testing procedures in effect to determine if septic disposal systems now installed are actually working to fulfill the purposes for which they were designed, produced, and installed in Guilford County. The percolation test is the major test upon which approval for the installation of the disposal system is based. There is little evidence that this test actually is a reliable means upon which to base this approval.

Where numbers of homes are concentrated upon soils which are generally unsuitable for septic disposal systems, periodic checks of watershed drainage would seem to be most imperative.

4. Priority Construction of Sewer and Water Lines:

A number of residences in Guilford County were established using septic tanks before Zoning and Health ordinances came into effect.

A sizeable number of these homes installed disposal systems in soils unsuited for this use. Compounding the difficulties incurred by the unsuitable soil is that both lot sizes (soil areas) are insufficient and consequent density of homes (and population) is high. This is a situation that cannot be tolerated if standards of public health are to be maintained and calls for a determined effort to relieve this dangerous condition.

5. Minimum Standards Applied to Soil Conditions:

Parties who intend to build upon tracts of land beyond access to sewer and water lines are cautioned to ascertain that the soil is suitable for use as a filter field. Failing to do this and discovering after purchase of the land that the soils inhibit this type of sewage disposal means they have incurred a substantial financial loss, but only for purchase of the land for the particular reason they wanted it.

Parties buying homes already constructed in residential developments stand to suffer a more severe financial loss. They make a greater investment of money, usually, with even less concern over the capabilities and responses of the soil base of the site. These purchasers assume that Zoning and Health regulations have adequately protected their interests by requiring developers and contractors to abide by certain standards which will insure that the structure and grounds will be safe, sanitary, and a satisfactory place to inhabit.

This assumption of consumer protection is correct to the point that the degree of quality of some aspects of his purchase is not called to his attention.

If an essential element in the home construction is unobservable to the buyer, or he is not experienced in making pertinent observations, or what he is able to see has no meaning to him, or his assumptions are over-extended, or for all or any combination of these reasons, he cannot make a sound judgment concerning the worth of his purchase.

Knowledge of the degree of quality of the soils of the home-site has a special significance to home-buyers. Because the properties of the soils which control percolation rates are the same properties that effect numerous other aspects of the home and grounds, the degree of favorable or unfavorable soil response to these other aspects becomes extremely important. A slowly permeable soil, for example, which just meets the minimum standards of the percolation test and is thereby approved for a septic tank system is the same soil that may be the underlying cause of many future difficulties with the dwelling and site. The inconveniences

endured and the additional expenditures made to correct these difficulties will be those of the purchaser at a future time. The properties of the soil which impedes the internal drainage of water will also effect other things such as: erosion of the grounds; undermining of fences, driveways, foundations; roughness of the yard surface, deposition of sediment from adjacent land; settling of foundations of walls, steps, patios; wet walls in the home; growth of molds and mildews; water seepage into basements; corrosion of underground utility lines and pipes; inhospitable growth conditions for grass and landscaping plants and for flower and vegetable gardens; ponding in the yard; hospitable breeding sites for insects. These results, to say the least, detract from the buyer's expectations of his home; they tend to make maintenance difficult and costly and accelerate deterioration of the property. The results of the percolation tests are unknown by the purchasers of completed buildings; they are only assured that a minimum standard, pertaining only to adequacy of the soil to receive septic tank effluent, was met. Coupled with this disadvantage is their personal inability to recognize certain surface indications that future trouble with the homestead is probable.

Inasmuch as the consumer is displeased with what might otherwise be enjoyable facilities and surroundings, he has not received the full value of his investment.

DRAINAGE BASINS FOR WATER SUPPLIES

The water needs of the major proportion of the population of Guilford County are being met by surface water impoundments. Reservoirs on the Reedy Fork Creek drainage system are the sources of water for Greensboro; reservoirs on the Deep River drainage system are supplying High Point. Wells presently supply water to Gibsonville, but a reservoir is contemplated on the Alamance Creek drainage system. Wells and springs serve most rural residences.

With the exception of air, no other natural element imposes such an immediate restriction upon physiological life as does the substance of water. And the demands of civilized man far exceed the use of water for physical sustenance alone.

These facts by themselves are sufficient to direct concerted attention upon the conditions of the water resources of the County.

Deep concern centers around not only the quantity of water that may be available for on-going needs, but also upon the purity of this supply of water, i.e., the quality of this water.

The quantity of water is dependent upon appropriate locations of dam sites relative to the catchment basins upstream from them, precipitation characteristics, and characteristics of the landscape from which rain-water flows.

The quality of water is dependent upon the degree to which man contaminates the in-flowing waters with waste or by-products from other uses on the watersheds.

Because the surface impoundments depend upon surface waters to form and replenish them, the relative purity of the watersheds from which the waters drain becomes the focal point of serious examination of high quality water supplies.

The specific types of pollutants together with their undesirable effects upon the ecology of water-courses, their effects upon reservoirs specifically will be covered in other sections of this paper.

In light of the over-all use of the land of the County, however, and the fact that watershed areas are being (and will be) used for a number of purposes, bacterial pollution from domestic sewage disposal and industrial plants with the individual treatment facilities requires special attention. To this date, existing reservoirs are not being filled in part with effluent from city and/or industrial sewage treatment facilities. Placement of dams to impound water for urban use to date has been determined to avoid the obvious and measured pollution of certain water courses by municipalities and industry. However, gone unrecognized and undetermined is the pollution from improperly functioning septic tank disposal systems from clustered residences upon reservoir drainage basins.

As explained in the preceding section, the soils of Guilford County together with the doubtful testing procedures to determine the absorptive capacity of these soils combine to make this source of bacterial pollution a dangerous potential if not an existing reality.

Page 12 of the Land Use Plan published by the Guilford County Planning Board in 1966 is a map showing significant areas of septic tank pollution. Two notable developments of concentrated housing upon watersheds feeding city reservoirs are Carlson Farms and Cedarwood.

As of the date of this writing, three sizeable drainage basins are yet unaffected by heavy industrial sewage waste and concentrated residential construction beyond sewer lines. These are Haw River west of U. S. Route 220, Alamance Creek, and Stinking Quarter Creek.

Housing developments and open space reserves must co-exist upon areas which form the catchment basins of water to be ultimately used for consumption and recreation of an expanding population. Although housing is needful for the welfare of the citizens of Guilford County now and in the future, residential development upon the watershed areas must not degrade the other uses of the limited territory of the County.

OPEN SPACE RESERVES

We hold that Guilford County is a beautiful and pleasing area in which to live. Its elevation and its geographical position on the continent (relative to latitude, to the Appalachian mountains and the Atlantic ocean, and to the prevailing air mass movements crossing the United States) make it a uniquely hospitable location for life of all kinds and pleasant surroundings for its human inhabitants. Its climate, soil, and terrain combine to form a favorable environment for the proliferation and growth of a great variety of plant life. This vegetation, in turn, supplies food and shelter for a wide spectrum of wildlife species.

The desire of older generations to pass this heritage on to their children is commendable. The social background of the majority of citizens in Guilford County is still rural oriented. This means that large numbers of people are knowledgeable in and appreciative of the skills involved in cultivating food and ornamental plants. The care in the landscaping of homes, maintenance of yards, attention to gardens, establishment of parks, etc., attest to this home training.

This desire for maintaining space for growing things and out-door living, however, is more than what might be termed a "want" for a comfort or luxury. Psychologists have established that, even beyond the space needed for physical exercise, human beings need room and open areas for mental well-being.

In a rapidly increasing population, this could well prove to be one of the foremost necessities if men are to "live," not merely to survive.

Further, in a society that is becoming increasingly boxed in by its own complexes of buildings and streets, subjected to strains of noise, odors and fumes of mechanical devices, distractions of artificial lighting, it may become an essential element of public education if future citizens are to truly understand their relationship with their natural world. Losing this touch with the earth, the future population could well acquiesce to and be totally dependent upon a regimented world of mechanically controlled elements.

Uncontrolled, indiscriminate use of land area can rapidly bring this process about. This is not an illusion; the megapolises and strip-cities of the north and west are confronted with severe space-use problems. Predictions of population growth together with its attendant needs for shelter and transportation facilities have marked belts of high density living across the nation. Guilford County stands in one of those belts. Based upon existing patterns of urban development, Guilford County is slated to be a very different area than it is today.

To meet all needs of the increasing population, and especially to meet the needs which open space provides for a healthy mental state of people, implementation of well-considered land use plans is required now.

The terrain of Guilford County, including relief and soils, are fortunately suited for the establishment of open space for a number of specific uses.

In the over-all perspective, the use of land for open space in no way diminishes the suitability of the space for the other extensive land uses for residential development with septic tank systems and watersheds for city water supplies. In fact, both such shared uses of the territory are enhanced by prescribed open space reserves.

Flood plains and steep valley slopes are unsuited for home construction, and, because they cross the County with the water courses which formed them, they make convenient locations, readily accessible for numerous open space activities. Areas containing soils which severely restrict the use of septic tank sewage disposal systems and other phases of residential development also occur generally throughout the County and are available for appropriate out-door uses. Hagan-Stone Park near Pleasant Garden is a prime example of how soils with these limitations may be used.

Two publications of the Guilford County Planning Board entitled "Open Space" (1966) and "Open Space and Recreation Implementation Plan" (1968) are digests of extensive and thorough studies of the factors of open space reservations. For this reason, the writers of this paper feel that detailed recommendations to candidates for elective offices are unnecessary.

One very important use of open space, however, was not given adequate coverage in these reports. It is necessary to mention it to reinforce the findings and proposals presented in the Planning Board publications.

Because of the numerous public schools, secondary educational institutions, and social and religious summer camps within the confines of the County lines (not forgetting additional building and expansion of these facilities in the future), there is an increasing need for ecological study areas, horticultural gardens, outdoor laboratories, wildlife preserves, nature study areas for formal and informal education. Administrative officials and faculty of these schools and camps would join wholeheartedly in promoting and utilizing open space set aside for this purpose.

The Atmosphere: Dominant Environmental Conditions

CHARACTERISTICS OF AIR

The air covering Guilford County at any given instant is approximately seven miles thick, is a mixture of various kinds of gases, is a carrier of very small particles dispersed throughout its body, is a fluid, and, although invisible, is physical matter. It not only covers the surface of the land but also gets into the soil, the water, the lungs of humans and other animal life, and all spaces of any kind of structure.

This invisible substance is critical to life processes principally for the reasons that it reduces the intensity of incoming radiation damaging to living tissue, it transfers heat to modify environments inhospitable to life, it carries water droplets and condensation nuclei from which rain forms, it supplies oxygen for the metabolic processes of most living organisms and nitrogen, a basic element of protein compounds forming animal and plant tissue.

It disperses pollen, spores, and seeds for vegetative regeneration and proliferation; it is the medium supporting the weight of flying birds and aircraft. Because it moves and has the capability to perform work, it is used to power windmills and sailboats.

Most significant to the understanding of local air pollution, however, is the fact that air is a physical substance, which, in its natural state, is a fluid. It reacts to external physical forces in the same manner as does other physical matter in the same state.

Addition of heat to a defined body of air energizes the molecules so that the mass becomes buoyant and less constrained by gravitational pull and/or confines of terrestrial formations. Withdrawing heat from a set volume of air contracts the molecular make-up so that it assumes more nearly the characteristics of a liquid. This is to say that the air is more susceptible to being controlled by the force of gravity and more readily conforms to obstructing walls of topographic depressions.

Although the general atmosphere moves on a global scale reacting to unequal seasonal and diurnal heating of the earth's surface and planetary rotation and spherical shape, air over local areas, when general atmospheric conditions are conducive, is influenced by gravity and inertia. The effects of local land conformations and vegetational features gain dominance in controlling air movement for varying intervals of time.

During these periods of time, the air "stagnates," moving very slowly from broad, level surfaces and/or becomes readily pocketed by the slopes of river and stream valleys.

The general atmospheric conditions which set up this local phenomena occur in Guilford County with a regularity that is predictable.

The Guilford County Board of Health has defined air pollution as "the presence in the outdoor atmosphere of one or more air contaminants or any combination thereof, in sufficient quantities and of such characteristics and duration as is or is likely to be injurious to the public health, including the health and well-being of human, plant or animal life."

The "contaminants" referred to are numerous and varied, and those that are the most abundant and/or injurious to life and property in Guilford County will be described later in this section.

Before naming the types of contaminants, a very significant point must be made at this time. The point concerns an elemental fact that is so commonly experienced that its meaning is largely overlooked as a logical starting place for systematic study of air pollution problems. This oversight is reflected in reports made of these studies. It is, simply, that air is the medium or carrier of these contaminants regardless of their size, form, or state.

The implications of this basic fact is that wherever the air goes, the contaminating material goes with it; whatever happens to the air in a physical sense, happens to the pollutants. Heated air expands and becomes lighter weight and more active in movement. Polluting gases and particles in the air are effected accordingly. They are diffused or broadcasted to a greater extent spreading widely throughout both the horizontal and vertical dimensions of the atmosphere. Cold air contracts, sinks, becomes increasingly sluggish as heat leaves it, and pollutant matter correspondingly reacts. It settles with the air, becomes increasingly concentrated and tends to stay in place. This is the nature of physical matter, and air is no exception.

This phenomenon has been observed and known by man since earliest times, yet the consequences of this fact seem to be treated lightly by many people involved in air pollution research.

This phenomenon relates directly to air pollution in Guilford County. Cold, heavy, dense air tends to flow to the lower elevations of the landscape, and there, along with the pollutants, becomes readily **pooled** by surrounding slopes and/or dense growing vegetation. This means that dwellings built on low lying sites are subject to more pollutional damage, and occupants of these homes breathe more impure air than those on the upland sites under the same conditions of pollutant emission. Low lying areas have a greater incidence of pollution than do higher elevations both in concentration and in frequency

of occurrence. It is not coincidental that complaints about pollution damage and sensory effects (fumes, odors, etc.) are most frequently heard from inhabitants whose homes occupy locations downhill from sources of pollution or are adjacent to highly noxious streams.

If results of various research and testing programs here in Guilford County, and elsewhere, are to depict the actual conditions existing, this basic fact of physical world should be a key factor in calculations. Various pollution control measures will need to contend directly with this factor in order to achieve practical results.

Classification of Sources of Air Pollution

Attempts have been made to classify sources of air pollution, one of the most common being "Industrial Sources" as distinguished from "Domestic Sources." Among other things, this classification acts to establish the culpability of parties for air pollution. It divides private polluters (specific commercial and industrial enterprises) and public polluters (everyone). Private polluters, according to this classification, pollute the air only by releasing certain gaseous or small-sized by-products of their industrial processes into the air. Public polluters foul the air by using automobiles, tractors, power lawn-mowers, motor-cycles, motor-bikes, ski-sleds, racing cars, coal and oil home heating systems, etc. This list of mechanical devices used widely in our modern society is long and ostensibly establishes the "domestic" sources of pollution as a very substantial contributor. The nameless "public" then becomes a leading accomplice in generating pollution.

Approaching the classification of sources of pollution from another direction markedly reduces the culpability of the general public. To aid in a deeper understanding of the basic sources of pollution, the authors have made a separation of two general sources of pollution to read, "Pollution from Industrial Sources," and "Pollution from Domestically-Used Manufactured Products." This more nearly indicates where the overwhelming bulk of pollution comes from. It also suggests where future regulatory measures might be applied to be most effective.

Sources of Pollution & Types of Pollutants in Guilford County

<u>Pollution from Industrial Sources (Type of)</u>	<u>Number of Operating Units</u>	<u>Types of Pollutants Emitted</u>
TEXTILE	102	Lint and fines from production waste, organic vapor or other mists from dyeing, bleaching, impregnating, cleaning. Smoke from combustion equipment for power and heating.

<u>Pollution from Industrial Sources (Type of)</u>	<u>Number of Operating Units</u>	<u>Types of Pollutants Emitted</u>
FURNITURE, LUMBER, & WOOD PRODUCTS	193	Fines and dust from milling operations. Paint and solvent emissions from surface coatings. Smoke from burning waste lumber, mill ends, fines, sawdust.
MACHINERY AND METAL PRODUCTS	106	Metallic fumes from melting operations in foundries; solvent mists and vapors from application of protective coatings in finishing departments. Smoke and fumes from quenching in tempering and heat treating.
FOOD AND KINDRED PRODUCTS	68	Most notable odors, particularly from rendering operations or from poor house-keeping and from handling by-products.
MINERALS: STONE, CLAY PRODUCTS	12	Dust from mechanical processes, smoke and fumes from kiln operations.
PRINTING AND PUBLISHING	-	Organic solvents from inks and cleaning
PAINTS, CHEMICALS, FERTILIZERS	51	Chemical technology makes possible all forms of pollution involving the emission of the chemicals and their end products and the derivatives or reaction products in process or in the atmosphere.

Note #1: Consumption of coal for fuel by industry in Guilford County in 1965 was 122,410 Tons. Consumption of coal for fuel used by commercial and domestic sources was 60,000 Tons. On a national level, industry used coal, oil, and natural gas around two-thirds the domestic fuel consumption.

Note #2: This outline lists only some standard manufacturing industries in Guilford County. It omits many smaller businesses such as laundries, dry-cleaners, earth-movers, construction, paving companies, etc. which also contribute a sizeable proportion of pollution to the air.

<u>Pollution from Domestically-Used Manufactured Products</u>	<u>Number of Operating Units</u>	<u>Types of Pollutants Emitted</u>
REGISTERED NON-COMMER-CIAL AUTOMOBILES & TRUCKS (internal combustion of mineral fuels)	173,000 (approximation based on 1969 registration)	The composition of automobile and diesel exhausts is characterized by greater amounts of carbon monoxide and hydrocarbons than that of emissions from other fuel burning processes.
ALL OTHER EQUIPMENT USING INTERNAL COMBUSTION ENGINE	unknown	
HOME HEATING UNITS (mineral fuels)	60,000 plus (based on modified 1960 Census)	The burning of coal produces several different kinds of gaseous pollutants, including carbon monoxide, nitrogen oxides, sulfur oxides, aldehydes, and hydrocarbons. The burning of coal also produces particulates (very fine physical material), one of which is benzo-pyrene which has been shown to be carcinogenic to laboratory animals. Natural gas produces the same types of pollutants as does coal with the additions of ammonia and organic acids. Oil combustion releases pollutants similar to those released by burning coal. Particulate emissions are considerably lower, however. As with coal, the sulfur oxide emissions vary with the content of sulfur in the coal.
Note #1: Mineral Fuel Consumption (1965) <u>Coal</u> for Commercial & Domestic was 60,000 tons <u>Petroleum Products</u> for Home Heating & Tobacco was estimated (1963) 56,789,000 gallons. <u>Natural gas</u> for Commercial & Domestic was 3,315,673 thousands cubic feet.		
Note #2: Aside from the improper use of the manufactured equipment, significant pollution from what might be termed "strictly domestic" sources is largely confined to open-air burning of trash, leaves, brush, etc.		

Effects of Air Pollution in Guilford County

The particular effects of given air pollutants have been thoroughly examined in many locations in the nation. These studies have separated specific chemical compounds, and physical particles, from the conglomerate of polluting materials and have determined their specific damage to things with which they have come into contact. The list of this damaging material is long, and to various indeterminate degrees, the prevailing air of Guilford County

also carries all of these contaminants. Certain pollutants, however, have been measured and shown to be present in our air. These measurements were made during a "preliminary" testing program in Guilford County in 1965. (Comments about this testing program will be made later) The results of this program indicated what some of the more common pollutants were (are). Undoubtedly there are other pollutants besides those collected and measured; the pollutants listed in the ensuing report reflect the capabilities of the testing equipment and the evaluation of the technicians making the tests. The list also reflects what some of the more noxious or dangerous pollutants are in the air.

It is not germane to this study of environmental conditions in Guilford County to relate in exhausting detail about what each polluting agent does. However, a non-specific account of the actual damage or potential damage by general pollution is appropriate. It sharpens the awareness of the cost of pollution.

Effects Upon Human Health:

As might be surmised, pollutants affect the sensitive membranes of human body tissue most radically. The eyes and the organs of the respiratory system are most susceptible. Cardiac reactions due to the increased strain of impeded breathing seems to be a correlative trouble. Persons with asthmatic or other respiratory infirmities are particularly affected.

Sulfur Dioxide is highly soluble in body tissues; the principal effect of this gas is irritation of the tissues lining the upper respiratory tract. Nitrogen oxides act as irritants upon pulmonary organs. Both of these compounds were detected in Guilford County and reported as follows: (1) "Sulfur Dioxide in the atmosphere is associated with combustion of sulfur containing fuels and industrial processes. The maximum level of 0.22 parts per million, found to exist in February of 1964, is near the taste threshold level of 0.30 ppm and exceeds the level of 0.20 ppm which has been shown to damage sensitive vegetation." (2) "The maximum level of total Oxides of Nitrogen (NO & NO_2) found in the 1965-66 study of 0.22 parts per million on February 23, 1966 is only slightly below the 0.25 ppm level at which adverse effects have been known to occur."

Episodes of extreme pollution and their results have been fully documented. In the Meuse Valley, France, in 1930, there were 63 deaths and 6,000 illnesses. In Donora, Pennsylvania in 1948, 20 people died and 5,910 became ill. In 1952, in London, 4,000 people died, and an undetermined number became ill. These episodes were similar in many ways; investigations revealed these common factors; (1) No single pollutant was present in sufficient concentration to produce the observed results. The combination of Sulfur dioxide and particulate matter was held suspect, however. (2) The segment of the population most severely affected was the cardio-respiratory disease group.

This last finding holds an ominous implication to citizens of Guilford County (and elsewhere). This is clearly stated in the training manual "Introduction to Air Quality Management" (U.S. Department of Health, Education & Welfare): "At the present time about 50% of our population is either over 65 years of age, or under 17 years of age. It is these groups that are more susceptible to the effects of air pollution on the respiratory system. Second, we are spending large sums of money for recreation areas, downtown redevelopment, and the general esthetics of our way of life. This, in turn, makes it more desirable to have an atmosphere of high quality so that we may enjoy these necessities of modern living."

Effects Upon Crops and Permanent Vegetation:

Sulfur dioxide, Fluoride, Smog and Oxidant (mainly Ozone), Ethylene, and herbicide and Fungicide vapors adversely affect vegetation.

Although these substances affect all vegetation in various degrees, of pointed significance to rural residents of Guilford County are the discoveries of research carried out at Beltsville, Maryland, Riverside, California, and at the Taft Sanitary Engineering Center in Ohio. High concentrations of ozone (formed by reactions of nitrogen and hydrocarbons under high light intensity) causes flecking on the upper surface of tobacco plants, tobacco wrapper C, and stipple of a minute dark brown to black lesions on the upper surface of grape leaves.

Estimates of visible damage to agricultural crops along the Atlantic Seaboard amount to about 25,000,000 dollars annually. This excludes losses due to repression of crop growth, maturity, and full yield.

Recent examinations have shown extensive damage to the tree growth of West Coast Forests.

Effects Upon Animals:

Little is known about the effects of air pollution upon wildlife. Direct observations in the field are hard to make, particularly when conditions of pollution exist, and conclusions as to the causes of sterility, unnatural development, still-birth of young, and decrease of life span are even more difficult to ascertain. We do know that some birds, notably canaries, are exceedingly susceptible to gases and may surmise from this that all birds, including wild birds, are affected in some manner by air pollution. There have been incidents which have indicated that highly polluted air inhibits directional and sensory capabilities of some migrating birds so that they become disoriented and/or fly into solid objects.

The Donora and London pollution episodes showed that domestic animals are directly affected by contaminated

air, even mortally. There is increasing proof, however, that air pollutants affect animals indirectly through their feed, principally grass and other forage crops. Cattle and sheep, especially, are poisoned from grazing on plants which have been subjected to pollution by the heavy metals, arsenic, lead, molybdenum, and also by fluorine.

Effects Upon Materials:

Pollutants in air affect materials through abrasion, corrosion (chemical reactions), and soiling.

The over-all economic loss because of this damage and despoilation is a tremendous amount. "Getting dirty" has been accepted as a fact of life by people, who, at the same time, have given little thought to the idea that they may get dirtier in some places than in others, and it is highly expensive to them to maintain cleanliness. They do not calculate their individual expenditures for cleaning and what the total cost adds up to be for groups of people.

Dr. Victor Salvin of Greensboro has recently completed an intensive study of the effects of air pollution upon textiles and cloth. He originally computed that all costs related to physical damage to cloth, loss of its color, etc., and need for frequent cleaning ran somewhat over one billion dollars annually for the nation. He has more recently stated that further evidence is accumulating to indicate that the one billion plus figure may have to be revised upward closer to two billion dollars per year for the nation. Included in these amounts are costs which are generally overlooked. Many materials require special treatment in the manufacturing stages to help them resist the degradation of air contamination.

This economic loss is just for textile products. Wood, stone, and metals of buildings, homes, and all other structures are severely affected and become both physically weakened and unsightly. Costs of repairs and refinishing or otherwise restoring this material on a national basis must be calculated logarithmically.

A side effect of this particularly devastating condition brought about by air pollution is that the use of solvents and other cleansing agents proportionately increases, adding still more to the burden of protecting the quality of our water.

Effects Upon Travel & Transportation:

The experience of driving in conditions of poor visibility is such a common one that the hazards inherent in this result of air pollution need only to be mentioned.

The hazards to aircraft operations under conditions of poor visibility are also too well known for lengthy explanations. The drama of and rightful concern for victims of

accidents related to poor visibility have over-shadowed the attention to the economic aspects of this effect of air pollution upon travel. To give a few illustrations of this commercial consideration, not only are insurance rates increased, but also, speaking of transportation, cargo goods get moved more slowly and expensively.

Effects Upon Use of Power:

Not only is additional fuel needed for transporting materials and people where poor visibility prevails, but increased demands are also put upon electric power supplies for illumination of homes, offices, streets, signs, etc. There is an added drain upon energy resources. If these energy resources are mineral fuels whose combustion products are released unrestrained into the air, the vicious cycle is completed. New York City experiences this condition as an on-going reality.

Effects Upon Human Behavior:

"Phototropism" is a term used by botanists to describe the physical responses of plants to light. Psychologists, among others, have long recognized that human beings also respond to light. This response is manifested in many ways, many of which can be easily observed in ourselves and in companions. Air pollution reduces the amount of light we receive both in intensity and in duration of exposure, and we react accordingly, both mentally and physically.

Government Agencies Involved in Air Pollution Abatement

Guilford County

Guilford County Health Department, Division of Environmental Health
Guilford County Planning Board

North Carolina

North Carolina Department of Air and Water Resources
North Carolina Public Health Service

Federal

U.S. Public Health Service, Department of Health, Education & Welfare
Environmental Science Services Administration, Weather Bureau

Determination of Air Pollution in Guilford County

Funded in part by Federal grants, two "exploratory" or preliminary air pollution testing programs were carried out in Guilford County, one prior to 1965 and one starting in Spring 1965, continuing through the winter months, and ending in March 1966. The basic purpose of this latter program was not to determine if Guilford County had polluted air or not, but, rather, how much of certain particular

types of pollutants were there and where did they appear to be in heaviest concentrations.

Essentially this was a "sampling" program taking air samples from certain locations selected by the technicians and measuring the amounts of specific contaminants of the sampled air.

A report entitled, "Ambient Air, Guilford County," describing the procedures followed together with the analyses data, was published and is available to the public.

Based upon the findings of this air sampling program, recommendations in the report were made to the Guilford County Board of Health. The first recommendation was:

"Adoption of a regulation by the Guilford County Board of Health to regulate and prohibit certain types of air contaminants emission into the air and provide a means of implementing such a control regulation program throughout the county."

This recommendation gained approval and led to the ordinance now in effect in Guilford County. (Critical examination of these regulations will be made in the following section)

Because this 1965-66 sampling program has been a moving influence in the establishment of the air pollution ordinance, and certain provisions and requirements therein, the findings should be more closely examined.

To a large degree a report of a scientific enquiry reveals the depth of perception of the individual who undertook the study. If the person who aids in the practical application of the study is the same one who made the study originally, a close look at the original study is not only proper but also importantly necessary to understand what future technical activities might be carried out.

What follows is information derived from the report "Ambient Air, Guilford County" description of procedures and results of analyses.

Analysis of 1965-66 Air Sampling Program

Types of Air Sampling Equipment Used:

Standard manufactured devices constructed to collect and/or measure the following air pollutant materials: Particulates (small physical particles suspended in the air); Oxides of Nitrogen (NO & NO₂); Sulfur (or Sulfur) Dioxide (SO₂); Dustfall. This is both stationary and semi-stationary equipment.

Analysis of Sample Contents or Flow:

Analyses of components of air sampled were made by given standard means.

Uniformity of Sampling:

All stations did not have the same sampling devices, they did not sample for the same polluting material, and sampling periods differed.

Positioning of Air Sampling Devices:

Geographic Locations

9 stations were located in the rural area

17 stations within Greensboro City limits

15 stations within High Point City limits

Pattern of Locations

3 clustered immediately south of the Greensboro City limits, rest scattered broadly at smaller communities and elsewhere

12 clustered in the approximate eastern half of Greensboro

12 clustered in south-central part of High Point around and southwest of Highway 311.

Topographic Location

NOT DESCRIBED IN REPORT (As most instruments were on the tops of various buildings and commonly these structures occupy the level upland positions, it is assumed that the instruments were set up in these upland positions)

Vertical Spacing

Many on tops of various buildings generally 10-15 feet above surface of the earth with a few exceptions.

Distance from Closest Observable Emission Sources

NOT GIVEN

Sampling Schedule:

FOR SUSPENDED PARTICULATE MATTER

Greensboro

<u>Number of Stations</u>	<u>Period Dates</u>	<u>Number of Days</u>	<u>Range in No. of Samples</u>	<u>Season</u>
14	27 May- 30 Sept. 1965	126	6-10; 11 sta. with 7 each	Spring & Summer
3	1 Oct. 1965- 31 Mar. 1966	182	6-8	Fall & Winter

Guilford County

6	27 May- 30 Sept. 1965	126	7	Spring & Summer
1	22 Feb.- 31 Mar. 1966	37	10	Winter

<u>Number of Stations</u>	<u>Period Dates</u>	<u>Number of Days</u>	<u>Range in No. of Samples</u>	<u>Season</u>
<u>High Point</u>				
6	1 Oct. 1965- 31 Mar. 1966	182	1 sta. - 6 2 sta. - 7 each 2 sta. -12 each 1 sta. -13	Fall & Winter

Summary

Spring & Summer Period (126 days for period: 27 May-30 September 1965)

<u>Greensboro</u>		<u>Guilford Co.</u>		<u>High Point</u>	
<u>No. of Stations</u>	<u>Av. No. Samples</u>	<u>No. of Stations</u>	<u>Av. No. Samples</u>	<u>No. of Stations</u>	<u>Av. No. Samples</u>
14	7	6	7	NONE TAKEN	

Fall & Winter Period (182 days for period: 1 October 1965-31 March 1966)

<u>Greensboro</u>		<u>Guilford Co.</u>		<u>High Point</u>	
<u>No. of Stations</u>	<u>Av. No. Samples</u>	<u>No. of Stations</u>	<u>Av. No. Samples</u>	<u>No. of Stations</u>	<u>Av. No. Samples</u>
3	7	See Below		6	9.5

Winter Period (37 days for period: 22 February-31 March 1966)

<u>Greensboro</u>	<u>Guilford Co.</u>		<u>High Point</u>
	<u>No. of Stations</u>	<u>Av. No. Samples</u>	
See Above	1	10	See Above

Associated Meteorological Events:

There were general remarks about the influences which meteorological factors exert upon air contamination throughout the report, but no specific data was presented, neither synoptic weather conditions which were applicable nor station site readings, of present weather at the times of samplings.

Reference is made in the report to a maximum Sulphur Dioxide content reading of 0.22 ppm at 5P.M. on February 27, 1964. Because this is a noteworthy amount which is well above 0.20 ppm shown to be damaging to plants, it would be informative to know what atmospheric conditions may have contributed to this. This stands as an example of the need for accompanying weather data.

Synoptic weather conditions are readily obtainable from the local Weather Bureau station at the Greensboro-High Point-Winston Salem airport. They also may be acquired from the Weather Records Center in Asheville, N. C.

Summary of Report:

The Summary section of the 1965-1966 Air Sampling program report reads: "Lower or higher concentrations of air pollutants may be found at all sampling locations within the county as weather conditions change or are influenced by wind speed, wind direction, and cloud coverage.

A summary of the results obtained through the sampling period would indicate that a higher than desirable concentration of air pollution exists, based on comparison with levels established in sections of the nation where major problems have existed and control measures have been undertaken.

As expected, higher concentrations of suspended particulate matter and soiling index values were heavier in the winter sampling period than in the warmer months. Higher concentrations were also found present in the industrial areas.

More detailed and concentrated efforts are needed on gaseous sampling to draw any firm and meaningful conclusions.

It is an accepted fact that the medical profession considers air pollution a health problem. Results shown in this report indicate that Guilford County does have an air pollution problem which is greater in the cities and industrial areas and is greater in winter than in summer."

Comparison of Recommendations in the "Ambient Air" Report with Provisions & Requirements of the Air Pollution Ordinance of Guilford County

On July 1, 1970, North Carolina's present air quality control standards became effective in 86 of the 100 counties in the State. Guilford County was one of the fourteen counties excluded from State controls because a local ordinance was already in effect.

The Guilford County ordinance is entitled, "Guilford County Board of Health Regulations Governing Air Pollution Control." It was adopted by the Guilford County Board of Health on August 26, 1966 and became enforceable as of January 1, 1967.

Repeating earlier statements, this ordinance was an outgrowth of recommendations proposed in the "Ambient Air" report of findings of the air sampling program. The leading recommendation of this report was that the Guilford County Board of

Health should adopt regulations to and prohibition of certain types of air contaminants emission into the air provide a means of implementing such a control regulation program throughout the county. Certain other specific proposals pertaining to this regulation were also made in this report to the Guilford County Board of Health. The response to these recommendations is reflected in the present ordinance. A comparison of the technical recommendations with the legal regulations adopted is informative:

Report Recommendations

"Adoption of a regulation by the Guilford County Board of Health to regulate and prohibit certain types of air contaminants emission into the air and provide a means of implementing such a control regulation program throughout the county

"Air quality monitoring It is essential that continuous surveillance of air quality be maintained to improve present quality, and to prevent additional overloading of the atmosphere with pollution emissions. This may be accomplished through the establishing of semi-permanent sampling stations throughout the area. These stations would house air-sampling equipment for the detection and measuring of the following pollutants:

- a. Sulfur Dioxide
- b. Oxides of Nitrogen
- c. Settleable Particulates
- d. Suspended Particulates

The results of this continuous sampling program would identify short-term variations and long term trends in pollutants for study and consideration for air quality goals."

Authors' Note: There are standard manufactured devices which can be used for this. Some of these which were used in the air sampling study are described in the report

Ordinance Provisions

Ordinance adopted August 26, 1967

"The purpose of these regulations is to promote and to encourage air pollution control and to regulate and prohibit certain types of air contaminants emission and to provide a means of sustaining an air pollution control program in the county.

"General Provisions

(b) Prepare and develop a comprehensive plan for the prevention, abatement, and control of air pollution and report periodically to the Board for revisions or additions to the regulations governing air pollution control.

(d) Conduct studies, investigations, and research relating to air pollution and its prevention, abatement and control."

"Emissions Prohibited

(a) No person shall discharge into the atmosphere from any single source of emission whatsoever any smoke for a period or periods aggregating more than four minutes in any one hour which is as dark or darker in shade as that designated as No. 2 on the Ringelmann Chart.

(e) No person shall cause or allow the emission of air contaminants from any source in such quantities and of such characteristics and duration so as to endanger the public health or create a nuisance."

Report RecommendationsOrdinance Provisions

Authors' Note: The Ringelmann Chart as a means of measuring air contaminants has definite limitations. It is best suited only for smoke emissions. No means are specified as to how the contaminants indicated in item (e) will be determined.

"Continuous emission inventory

It is essential to an air quality control program that a tabulation of air pollutant emissions from sources of manufacturing, industrial, education, and institutional establishments be accomplished and maintained. This is helpful to planning and zoning agencies in land use planning as well as determining air use of an area; also it is essential to source findings and control of air pollution."

Allowance to conduct such a type of inventory is made in the ordinance provisions (b) & (d) of the General Provisions. These items were quoted on page 17.

"Source identification or source

finding It will be of major importance to an air quality control program that air-sampling equipment now available be utilized to locate and identify heavy concentration of emissions. This may be accomplished by selecting and utilizing air-sampling sites near and around known or suspected sources of pollution for concentrated efforts of sampling procedures."

General Provisions (b) & (d) quoted on page 17 also permit this type of survey.

"Education It will be very beneficial to a future program to continue with an educational program on air pollution and air pollution control directed to industry and the general public."

"General Provisions

(e) Collect and disseminate information and conduct educational and training programs relating to air pollution."

SPECIAL NOTE: The air pollution control ordinance also includes this section:

"Air Pollution Advisory Committee

For the purpose of considering amendments to these regulations, enforcement of the provisions of these regulations and establishing air contaminant emission standards in these regulations, the Board shall name and appoint an Air Pollution

Advisory Committee whose members shall sit with the Board in an advisory, non-voting status. Advisory members shall include one planner each from the City of Greensboro Planning Department, the City of High Point Planning Department, and the Guilford County Planning Department; also, one representative of industry, one representative of agriculture, and one representative of the general public. Advisory members shall serve two year terms without compensation and shall receive proper notice of all meetings of the Board at which air pollution matters may be discussed."

Deficiencies in Air Sampling Techniques

The placement of the air sampling instruments used in the 1965 sampling program indicated that insufficient consideration was given to the characteristics of cold air and its reaction to the topographic conformations of the earth. Such casual treatment in an air quality survey results in findings that overlook the worst conditions of air pollution. The heaviest concentrations of pollutants should be the condition ruling any air pollution abatement program.

Sampling "ambient" air or moving air is a misdirection of efforts. Except for areas immediately adjacent to or in the vicinity of sources of heavy emissions of a contaminant, the more severe effects of air pollution, especially in terms of human health, are felt when the air is "stagnant" or calm (less than 3 miles-per-hour wind speed). Moving air diffuses and disperses the pollutant. Readings made of instruments placed on elevated sites, 10-15 feet from the surface of the earth which itself is higher terrain, show pollution of air which is most likely to be moving. This is not representative of areas where concentrations of pollution, under the same atmospheric conditions and intensities of emission, would be the heaviest.

Heavy accumulation of pollutants may occur in Guilford County when these atmospheric conditions prevail: (1) When the air becomes very stable, i.e., when it becomes cold, dense, slow moving (low wind speeds). (2) When underlying cooler layers of air in contact with the earth are constrained from rising by warmer layers of air overtopping them (temperature inversion). These two conditions are relatively common in this area. Whenever a land area undergoes extreme outgoing radiation (loss of heat to open space) unrestrained by a blanket of clouds (and no warmth is added by incoming air), the first condition, above, prevails. This is a regular occurrence during the cloudless days and nights of October and November, our driest months. When two continental air masses come to butt against one another without moving for prolonged periods of time (3,4,5 days), regions under the influence of those masses of air may be subjected to the second condition, air inversions. The stationary frontal conditions of late June, July, and August commonly lead to the entrapment of surface air in Guilford County.

It should be understood that the movement of cold, dense, viscous air is analogous to the flow of a liquid, it will seek the lowest levels of a container (the irregular conformation of the earth's surface) and form pools or semi-stationary accumulations whenever its flow is impeded. The obstructions blocking or restraining movement of cold air do not have to be outstanding. This natural phenomenon of cold air flow and movement is not restricted to mountainous areas. The Piedmont terrain is quite suitable to produce this condition. Pollutants carried in the cold air concentrate in the low-lying areas or depressions.

Because of this, sampling of ambient air of open areas is less likely to reveal the most undesirable conditions of contamination than sampling of stagnant air occurring during conducive atmospheric conditions in the many stream and river valleys crossing the County. The sites upon which air sampling or monitoring equipment is placed should be selected not only on the basis of geographic coverage, distances from emission sources, and prevailing winds, but also, most realistically, on a topographic basis as well.

The authors surmise that the monitoring or a continuous surveillance of air pollution, recommended in the report, will follow the pattern established by the air sampling program. Recognition of the influences which land relief, vegetational growth, and soil moisture conditions have upon the air coming into contact with the earth should be reflected in the location of monitoring instruments. Placement of instruments upon higher elevations to check conditions of air pollution necessitates a greater reliance upon the distribution of stations based upon relative proximity to emission sources than would be the case **were** they spread more widely in strategic locations of low-land areas.

Authorities have suggested "zoning" as one measure to aid in air pollution abatement. Topographic "quadrangle" maps published by the U. S. Geological Survey or Standard Soil Survey maps of the U. S. Soil Conservation Service could be utilized to define zones for this purpose in Guilford County. Based upon the relationships involved between monthly meteorological events, topography, and actual or potential emission sources, useful zoning maps could readily be drawn.

Deficiencies in the Guilford County Ordinance to Regulate Air Pollution

Because the air pollution control ordinance is relatively new, the Guilford County Board of Health wisely included a provision which gives a built-in flexibility to the law. The law provides for the appointment of an Air Pollution Advisory Committee to propose amendments to the law as new information and/or changing environmental conditions require them. The provision states: "Advisory members shall include one planner each from the City of Greensboro

Planning Department, the City of High Point Planning Department, and the Guilford County Planning Department; also, one representative of industry, one representative of agriculture, and one representative of the general public."

The assumption drawn from this provision is that the Guilford County Board of Health seeks the aid of persons who are capable of giving sound technical advice; this advice then to be translated into law if judged necessary to do so.

The principal objection to the ordinance as it now stands is with this provision; specifically with the category of membership upon this advisory committee. In terms of establishing an advisory group which is better balanced with specialists knowledgeable in fields intimately related to atmospheric pollution, the membership category stated is too broad.

In dealing with the problems of air pollution with its very real massive threat to the general health of the public, technical, scientific advice predicated upon this sole consideration should over-ride all other considerations. The make-up of the advisory committee includes not only three planners, who are technical people directly concerned with the welfare of the populace, but also an unspecified "representative of industry, one representative of agriculture, and one representative of the general public." For the technical knowledge of the more detailed and complicated aspects of air pollution, appropriate specialists should be specifically named by professional title to this advisory group. Further, they should be representatives of the public and the thrust of their advice should be toward maintaining the health of all citizens in Guilford County unbiased by any consideration beyond that.

Special Comment:

A recent newspaper article cited the findings of a report produced by the U.S. Department of Health, Education and Welfare describing air pollution nationwide and the "ranking" of the Greensboro-High Point area on a national S.M.S.A. scale.

65 S.M.S.A.'s (areas of population delineated by the Census Bureau) whose industrial population totaled 40,000 or more were listed in numerical order from the most polluted to the least polluted air. Guilford County was rated 65th, or as having the cleanest air.

Newspaper accounts such as this tend to mislead an unthinking populace of a "clean air" region into unwarranted complacency for the following reasons:

1. The air sampling or testing procedures were not explained to validate findings.
2. The relative severity of the air pollution (both by types of pollutants and respective concentrations) for the entire array of S.M.S.A.'s was not reported.
3. The relative severity of the air pollution (again by types and concentrations, respectively) was not explained for our area.

Water Resources: Dominant Environmental Conditions

SOURCES OF WATER SUPPLIES IN GUILFORD COUNTY

Citizens of Guilford County get their water from the following sources:

<u>Community Served</u>	<u>Reservoir; Name & Size</u>	<u>Location of Reservoir</u>	<u>Drainage System Dammed; Water-course & Size</u>
Greensboro	Lake Higgins, 280 acres	Guilford Co.	Brush Creek, 12 square miles
	Lake Brandt, 787 acres	Guilford Co.	Reedy Fork Creek, 75 square miles
	Lake Townsend, 1400 acres	Guilford Co.	Reedy Fork Creek, 105 Square miles
High Point	Lake High Point, 364 acres	Guilford Co.	Deep River Fork, 61 square miles
	New Lake, 632 acres	Guilford Co.	Deep River Fork, 32 square miles
Jamestown	Lake Oakdale	Guilford Co.	Deep River 71 square miles

Gibsonville is served by deep wells in both Guilford and Alamance Counties. Rural residences are served by individual wells and springs.

Governmental Agencies Involved with Water Supply in Guilford County

The following governmental agencies and officials either work cooperatively or are directly responsible, or both, in some phase of a total operation which determines the physical amount or quantity of water that consumers receive now or must have in the future. Inter-relating factors that determine the amount of water that consumers ultimately receive are (1) location of dam sites upon the landscape, (2) physical construction of the dam, including all mechanical appurtenances, (3) transportation of the water, and (4) treatment of raw water into potable water.

United States Government Agencies

Army Corps of Engineers
Bureau of Outdoor Recreation, Fish and Wildlife Service
Environmental Science Services Administration
Geological Survey
Federal Water Pollution Control Administration
Soil Conservation Service

North Carolina Agencies

North Carolina Department of Water and Air Resources

Guilford County Agencies

Guilford County Engineer
Guilford County Planning Board
Guilford County R.C.&D. Water Resources Committee

Cities

Greensboro Water and Sewer Department
 High Point Public Works Department
 Gibsonville Town Manager
 Jamestown

Requested and Proposed Actions Affecting Water Supplies

The City of Greensboro, the Guilford County Board of County Commissioners, and seventeen county and community organizations have requested long range planning (50 year plan) by the North Carolina and Federal agencies now engaged in a study of the Upper Cape Fear River Basin (above Fayetteville) on both Buffalo Creeks and the Lower Reedy Fork Creek.

The U. S. Corps of Army Engineers and the U.S. Soil Conservation Service studies indicate (published report due in 1971 or 1972) that the Engineers' projects on the Haw and Deep Rivers will provide almost enough water for needs during the next 50 years. The U.S. Soil Conservation Service has found several good dam sites on Alamance Creek which, at the time of this writing, is completely undeveloped.

Guilford, Rockingham, Alamance, Caswell, Orange, and Chatham Counties are represented by interested citizens forming an organization known as the North Central Piedmont Resource Conservation and Development Project of North Carolina. This organization is under the auspices of the U.S. Department of Agriculture. The Guilford County R.C.&D. Water Resources Committee of this parent group have recently requested flood control and pollution abatement studies of creeks flowing out of Greensboro to be included in the Upper Cape Fear River studies.

General Findings

A primary need is a well informed local public that will learn what local problems are, and take time to inform local people, State and Federal officials. For example, the City of Greensboro had severe flood damage on June 15, 1969, and pollution of creeks flowing through Greensboro has been serious for years, yet no one complained about floods or pollution at the hearings on Haw River problems held in Graham and Greensboro.

The Resource Conservation and Development organization needs more dedicated citizens who want to protect the environment. If a few highly interested citizens can be found to work toward this goal, Federal funds will probably become available to improve the quality of water, lengthen the useful life of the Greensboro and High Point reservoirs, and greatly improve recreational areas.

Nature lovers should be studying the Haw River in Rockingham and Guilford Counties for the purpose of preserving wild land in connection with the Altamahaw and Benaja reservoir projects (west of U.S. Highway 29) which are under study by the U. S. Corps of Army Engineers. There is a surprising amount of swamp land and hilly, forested upland. Not all of this land is likely to be used for reservoir storage of water. This land may qualify under the Wild Rivers Act for purchase and preservation.

QUALITY OF WATER IN GUILFORD COUNTY

The water of the streams and rivers which are free of man-made pollution is of very high quality and contains a low mineral content. Due, however, to extended periods of drouth principally during the Fall season, the streams have a very low flow. This means that there must be a substantial impoundment of water for in-take needed by the municipalities during the dry periods. It also means, at the same times, these streams have very low assimilative capacity for sewage effluent released by the treatment facilities of these cities. Federal plans for reducing pollution in Haw River call for storage and release of water of good quality in the Corps of Engineers projects, but no water to augment stream flow when necessary to do so as a future action has been found in Guilford County.

The degradation of water from its natural state results from man releasing contaminants into it. A major portion of the contamination is contributed by municipal and industrial sewage treatment plants; the contaminant being the effluent remaining after incoming material has been processed. Consequently, the functioning of these treatment plants and further treatment of their discharges into water-courses below them are operations that directly affect water quality. Sewage treatment difficulties for major communities in Guilford County are as follows:

Greensboro Area

North Buffalo, South Buffalo, and lower Reedy Fork are unclassified because water quality is not high enough to meet the lowest North Carolina Water Quality Standard of "D" which requires a minimum of three (3) parts per million of dissolved oxygen. Sewage treatment in Greensboro is expected to average better than 90% efficiency, but because of small volume of fresh water in the water-courses and the pollutants from storm sewer and land drainage, this treatment is not enough to raise water quality to the point where fish can survive. Recent upgrading of the South Buffalo Sewage Plant of Greensboro should prevent nuisance conditions on that creek, but that is not enough to get water of reasonably good quality flowing in the stream.

High Point Area

A future reservoir is proposed impounding waters of the Deep River system near Randleman, North Carolina. This supply would serve a portion of High Point needs. A major problem for the High Point area is to maintain high quality water in the Randleman reservoir. Releasing sewage effluent into Deep River waters (now being done by High Point, Jamestown, and the Sedgefield Sanitary District) which will form this reservoir will prove unsatisfactory. Even with present standards of sewage treatment, problems due to excessive algae growth will result. Army Engineers have recommended that the reservoir be established with the provisions that sewage effluent be piped to by-pass the impoundment or that a more intensive treatment of the sewage be carried out for a higher degree of removal of organic matter and phosphates.

Gibsonville Area

Existing sewage treatment plants for Gibsonville are inadequate and should be rebuilt.

Governmental Agencies Involved with Water Quality in Guilford County

The following agencies are principally responsible directly or indirectly for maintaining the purity or quality of the water in Guilford County:

United States Government Agencies

Federal Water Pollution Control Administration
Public Health Service

North Carolina Agencies

North Carolina Department of Water and Air Resources
North Carolina Public Health Service

Guilford County Agencies

Guilford County Health Department

Legal Requirements

The North Carolina Department of Water and Air Resources has established classifications and water quality standards. Although at the time of this writing this department is considering amendments to the present classifications and water quality standards, the information which follows describes the legal requirements now in effect.

The following excerpts are from "Classifications and Water Quality Standards Applicable to Surface Water of North Carolina."

Class A-I

Best Usage of Water:	Source of water supply for drinking, culinary, or food-processing purposes or any other usage requiring water of lower quality
Conditions Related to Best Usage:	This class is intended primarily for waters having watersheds which are uninhabited and otherwise protected as required by the State Board of Health and which require only approved disinfection, with additional treatment when necessary to remove naturally present impurities, in order to meet the "Public Health Service Drinking Water Standards" and will be considered safe for Drinking, Culinary, and food-processing purposes.

Class A-II

Best Usage of Water:	Source of water supply for drinking, culinary, or food-processing purposes and any other best usage requiring waters of lower quality.
-------------------------	----------------------------------------------------------------------------------------------------------------------------------------

Conditions Related to Best Usage: The waters, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to remove naturally present impurities will meet the "Public Health Service Drinking Water Standards" and will be considered safe for drinking, culinary or food-processing purposes.

Class B

Best Usage of Water: Bathing and any other usage except as source of water supply for drinking, culinary, or food-processing purposes.

Conditions Related to Best Usage: The waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor bathing places and will be considered safe and satisfactory for bathing purposes. Also, suitable for other uses requiring waters of lower quality.

Class C

Best Usage of Water: Fishing and any other usage except for bathing or as a source of water supply for drinking, culinary or food-processing purposes.

Conditions Related to Best Usage: The waters will be suitable for fish and wildlife propagation. Also, suitable for other uses requiring waters of lower quality.

Class D

Best Usage of Water: Agriculture, industrial cooling and process water supply, fish survival and any other usage, except fishing, bathing, or as a source of water supply for drinking, culinary or food-processing purposes.

Conditions Related to Best Usage: The waters without treatment and except for natural impurities which may be present therein will be suitable for agricultural uses and will permit fish survival. The waters will also be usable after special treatment by the user as may be needed under each particular circumstance for industrial purposes, including cooling and process waters.

The Guilford County Health Department is the regulatory agency which enforces the "Public Health Service Drinking Water Standards." These standards state specifically what qualitative and quantitative test measurements are required for water that is ingested by or comes into intimate contact with human beings for the protection of their health. Pertinent test measurement requirements are as follows:

Class A-I

Maximum coliform bacteria ... 50/100ml.

Class A-I
(continued)

Minimum oxygen content ... 5 mg./liter (ca. 5ppm)

Class A-II

Maximum coliform bacteria ... 1000/100 ml.

Minimum oxygen content ... 5 mg./liter (ca. 5ppm)

Class B

Maximum coliform bacteria ... 200/100 ml.

Minimum oxygen content ... 5 mg./liter (ca. 5 ppm)

Class C

Maximum coliform bacteria ... 100/100 ml.

Minimum oxygen content ... 5 mg./liter (ca. 5 ppm)

Class D

Maximum coliform bacteria ... 1000/100 ml.

Minimum oxygen content ... 3 mg./liter (ca. 3ppm)

Not less than 6 mg./liter (ca. 6ppm) for all trout waters ... min. oxygen content

Sources of Water Pollution in Guilford County

The sources listed below are contributing major amounts of contaminants to the surface waters of Guilford County. The type of contaminating material is given. This list includes pollutants that are not and have not been readily observable, measured, or generally have not been recognized as common pollutants as well as those that are easily noticed or previously measured or have been generally recognized as polluting substances. Projection of the effects of continued pollution (or beginning pollution) is indicated by the inclusion of the column headed "Other Reservoirs Effected."

<u>Source & Type of Pollution</u>	<u>Significant Water- course Effected</u>	<u>Present Reser- voir Effected</u>	<u>Other Reser- voir Effected*</u>
<u>ORGANIC MATTER & BACTERIOLOGICAL</u>			
Gibsonville			
Northside Plant	Haw River	-	New Hope
Southside Plant	Alamance Creek	-	New Hope
Greensboro-High Point Airport	Reedy Fork Creek	Lake Higgins Lake Brandt Lake Townsend	New Hope

Sources of Water Pollution in Guilford County (continued)

<u>Source & Type of Pollution</u>	<u>Significant Water- course Effected</u>	<u>Present Reser- voir Effected</u>	<u>Other Reser- voir Effected</u>
Greensboro			
North Buffalo Plant	N. Buffalo to Buffalo	-	New Hope
South Buffalo Plant	S. Buffalo to Buffalo	-	New Hope
Greensboro Mobile Homes Country Club	Deep River	Lake High Point	Randleman
Green's Trailer Park	Deep River	Lake High Point	Randleman
High Point #1	Deep River	-	Randleman
Hunting Valley Subdivision	Deep River	-	Randleman
Jamestown	Deep River	-	Randleman
Julian Shopping Center	Stinking Quarter Creek to Alamance Creek	-	New Hope
Morgan & Sons Poultry, Inc.	Reedy Fork Creek	Lake Higgins Lake Brandt Lake Townsend	New Hope
Pine Meadows Trailer Park	Deep River	-	Randleman
Reidsville Sewage Plant	Haw River	-	New Hope
Richardson Village	S. Buffalo to Buffalo	-	New Hope
Sedgefield Sanitary District	Deep River	-	Randleman
Stancil Trailer Park	Little Alamance to Alamance Creek	-	Alamance Creek New Hope
Sykes Trailer Park	Deep River	-	Randleman
Whites Mobile Home Park	N. Buffalo to Buffalo	-	New Hope
<u>CHEMICAL</u>			
American Agri- cultural & Chem. Co.; Greensboro	Subsurface drainage	-	-

(continued)

<u>Source & Type of Pollution</u>	<u>Significant Water- course Effected</u>	<u>Present Reser- voirs Effected</u>	<u>Other Reser- voirs Effected</u>
Armour & Co; Greensboro	S. Buffalo to Buffalo	-	New Hope
Cone Mills Corp; Greensboro	N. Buffalo to Buffalo	-	New Hope
Foremost Screen Print Company Stokesdale	Rocky Branch to Haw River	-	New Hope
Swift & Co. Plant Food Div; Greensboro	S. Buffalo to Buffalo	-	New Hope
Troxler Hosiery	S. Buffalo to Buffalo	-	New Hope
<u>HERBICIDES & PESTICIDES</u>			
Farms, Nurseries, Gardens, Electric Power Lines, and Highway Right-of-way Main- tenance	ALL	ALL	ALL
<u>SEDIMENTATION FROM EXPOSED SURFACES</u>			
Superior Stone Co. Hycone Rd. Quarry	Reedy Fork	-	New Hope
Pomona Quarry	Deep River	Lake High Point	Randleman
Jamestown Quarry	Deep River	-	Randleman
Central Rock Co. Buchanan Quarry	Little Alamance to Alamance Creek	-	Alamance Creek New Hope
Vulcan Materials Co. Stokesdale Quarry	Troublesome to Haw	-	New Hope
Boren Clay Products Pleasant Garden #1	Polecat	-	Randleman
Pleasant Garden #2	Polecat	-	Randleman
<u>COMMERCIAL & INDUSTRIAL SITE PREPARATIONS (major examples)</u>			
Greenbriar Mall Shop- ping Center	S. Buffalo Creek	-	New Hope
Greensboro-High Point Airport	Reedy Fork Creek	Lake Higgins Lake Brandt Lake Townsend	New Hope

(continued)

<u>Source & Type of Pollution</u>	<u>Significant Water-course Effected</u>	<u>Present Reservoirs Effected</u>	<u>Other Reservoirs Effected</u>
Four Seasons Shopping Center	S. Buffalo Creek	-	New Hope
Industrial Development at I-40 and Sampson Road	Deep River	Lake High Point	Randleman
Northwest Area	Reedy Fork Creek	Lake Brandt Lake Townsend	New Hope
S. Elm Street Industrial Area Greensboro	S. Buffalo to Buffalo	-	New Hope
Western Electric Laboratories	Alamance Creek	-	Alamance Creek

RESIDENTIAL DEVELOPMENTS

ALL	ALL	ALL	ALL
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ROAD CONSTRUCTION

ALL	ALL	ALL	ALL
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GENERAL FINDINGS

*includes proposed reservoirs

Not any of the streams in Guilford County are classified as A-I, the highest and most restrictive classification. The upper reaches of the Haw and Deep Rivers, Big and Little Alamance Creek, Reedy Fork Creek and Polecat Creek are classed as A-II. The major municipalities of Guilford County obtain their water supply for drinking from this classification.

Most of Buffalo Creek, North and South, and Reedy Fork from the Buffalo Creek confluence eastward to Haw River are "unclassified." (Formerly "E" classification.)

Either method of protection the quality of the water of the proposed Randleman reservoir from the sewage discharge of High Point et al (as proposed by the Army Engineers) should provide water of good quality for municipal use and recreation.

Upgrading of the South Buffalo Treatment Plant of the City of Greensboro and channel improvement should prevent nuisance conditions on that creek, but that is not sufficient to get water of reasonably good quality.

BACTERIAL POLLUTION OF SURFACE WATERS OF GUILFORD COUNTY

Living organisms too small to be seen without a microscope are called micro-organisms. There are numerous kinds of micro-organisms; one type is called "bacteria". There are bacteria which are beneficial to human life (and all higher animals), and some termed "pathogens" or disease bacteria which are inimical to human health. Without "good" bacteria, life would not be able to exist. To quickly recognize the truth of this, one only needs think about the decay bacteria which reduce inanimate organic material (with the exception of some synthesized substances) back to the primary elements of the world, and what the results would be if they did not do so, and the "nitrogen-fixing" bacteria on the roots of some plants; these assimilate gaseous nitrogen, transmit it to the plants from where it ultimately reaches animals to become the principle element of their living, developing body tissues.

As with many other things, man focuses his attention upon the "bad" or disease bacteria because of their harmful effects upon human health. Man expends much effort in controlling these organisms. It should be noted however, what bacteriologists and medical people have known for years, that in applying means to destroy undesirable bacteria in living systems and in the environment (unless the destructive agent is "specific" in only eliminating the pathogen) that many beneficial bacteria and other micro-organisms are also destroyed. Thereby ecological balances once again may be upset by man.

Bacterial pollution is generally thought of as pollution by the disease bacterial organisms. Because water is an efficient carrier of these organisms (sunlight upon open exposures and predatory micro-organisms in soil limits the growth and spread of many pathogens in these mediums), careful analyses of water, particularly, is made to discover their presence.

A passage in the book by Arthur, Charles A, and Bryan, Charles G., Bacteriological Principles and Practices succinctly describes the types of and reasons for testing water:

"The suitability of a water supply is determined by four types of analyses: (1) The chemical analysis determines total solids, hardness, etc., and detects any harmful chemical ingredients, such as poisonous lead or zinc salts. (2) The physical examination determines if the water has any objectionable turbidity, color, taste, or odor. (3) The biological analysis detects algae, fungi, protozoa, nematode worms, the smaller species of Crustacea, and the most valuable examination and is vital in preventing epidemics as a result of water pollution.

The bacteriological examination of water usually involves (1) estimation of the number of bacteria as determined by total plate count, and (2) the more significant detection of the presence or absence of members of the

coliform group. Finding these organisms in a water supply is taken as evidence of fecal contamination and, therefore, of possible presence of the intestinal pathogens causing typhoid fever, paratyphoid fever, dysentery, and cholera."

The history of epidemics only need be recalled to understand the reasons for the very extreme precautionary measures which must be taken to protect against bacterial pollution. Not only have countless numbers of persons been victims from imbibing diseased water from just a single source of contamination, but also, before succumbing, have themselves transmitted the disease widely to others.

In Guilford County, water which may bear the pathogens causing the diseases named by the Bryans (and including hepatitis) comes through two principle types of disposal systems, municipal systems and domestic septic tank systems. Because "sewage" is concentrated at treatment plants and is obviously a potential source of contamination, close check of bacterial pollution is made here. Obviously, such pollution will not be allowed to occur at these places; corrective measures will be taken. The major threat of bacterial pollution lies outside of the municipal systems largely because the potential goes generally unrecognized.

Laboratory Tests for Bacterial Pollution

The Guilford County Health Department conducts laboratory tests locally to determine bacterial pollution. Generally they follow standard methods of the American Public Health Association. Because the organism, Escherichia coli, a coliform bacteria, grow in the intestinal tracts of human beings where pathogenic organisms may also grow, the underlying presupposition of these tests is that if E. coli is found in water, the water may also contain the disease organisms.

Deficiencies in Testing Procedures in Guilford County

1. The U.S. Public Health Service standards to protect drinking water transported by common carrier establishes that not more than 10% of all standard 10 milliliter portions examined in a month shall show the presence of coliform bacteria. This implies that a systematic, scheduled or timed testing procedure is necessary to insure continuous safety. As noted in an earlier section, "Residential Development Beyond Sewer and Water Lines," there is presently no such systematic or continuous examination and testing of waters from sub-watersheds where dwellings beyond sewer lines are situated. In light of the dubious capacity of many soils to absorb septic effluent adequately, seepage from septic systems is a real potential. Concentrated housing occurs on the watersheds of reservoirs supplying city water; the cumulative effect of many septic tank systems upon the soil of limited areas is unknown. As this type of construction increases beyond sewer lines, the hazard proportionately increases.
2. Tests are made of wells and other sources of water only if the well is suspected of contamination. Both of these deficiencies, 1 & 2, strongly suggest that maintenance of public health in Guilford County depends more upon reaction to a dangerous situation rather than early detection and prevention of that condition in the first place.

CHEMICAL POLLUTION OF SURFACE WATERS OF GUILFORD COUNTY

When foreign solid material is added to water, the following reactions may take place: (1) the material may become physically divided into particles small enough to be temporarily carried by or "suspended" in the water (2) the material may be physically divided into even smaller particles which become dispersed throughout the water and are carried by the water for long periods of time.

Foreign liquid material introduced into the water may (1) become diluted or weakened, or (2) retain its identity as a lighter or heavier substance to either float upon the water or sink to lower levels.

Gases released into the water for the most part will rise to the surface and dissipate into the air although a significant portion of some will go into solution.

All substances, however, may undergo chemical reactions with one another in the water and with the water itself to form new materials whose immediate and/or ultimate effects are difficult to ascertain. These chemical reactions may take heat from the water or release heat to the water (adding to the heat received by sunlight).

Water, therefore, acts as a carrier, a chemical reagent, and/or a medium for the foreign matter it acquires. This foreign matter may have an "organic" source (whose dominant element is carbon) or an "inorganic" source (mineral compounds lacking the element carbon). When either or both organic or inorganic substances reach a given quantity in water or their chemical or thermal reactions attain levels that disrupt natural ecological balances established in and along our waterways and bodies of water, they are pollutants.

Inasmuch as this polluting material is not composed of living organisms which, of themselves, are dangerous to physical health, or it does not cause deleterious effects by physical obstruction, they are chemical pollutants.

Pollution by Detergents

The hard detergents cause unsightly foam on water surfaces and reduce or interfere with certain bacterial activity. The soft, decomposable detergents act as fertilizers to promote algal growth or "blooms". Some soft detergents are as much as 70% phosphate and each pound of phosphate can propagate 700 pounds of algae. At these rates of growth, the algae becomes a serious competitor for the available oxygen in the water where it grows; fish will swim away from waters containing this stimulated growth, or, if unable to escape, will die from the lack of the proper amounts of oxygen. Algal growth of this magnitude is cyclic; when the existing bloom dies, it settles to the bottom of the water, decays, and thereby supplies phosphate nutrients to a succeeding crop of its kind. Previously clear water can become quickly turbid with algae rendering the water undesirable for swimming and unsuitable for drinking or fishing.

Pollution by Oil Products

Oil products are used widely in Guilford County not only for home heating and family vehicles, but also for our numerous "flue-cured" tobacco sheds throughout the county and for the many large commercial trucking firms and airport established here. The oil reprocessing plants, storage tank farms, oil pipelines and railroad tank-cars, airport supplies, tanks at service stations, and traveling tank-trucks all pose a very real, serious potential for pollution of waters with this type of organic material. Oil spills from tank-trucks involved in traffic accidents have been flushed "away" by police and firemen in the past; washing away spilled oil from the aprons of service stations is standard practice; draining away waste oil from repair shops is also accepted procedure. This is active pollution, but it is insignificant in comparison with the magnitude of a potential accidental spill on reservoir watersheds.

The disastrous results of oil vents and leaks in other parts of the nation and the world are well-known. The oil floats as a film upon the surface of the water to coat everything in its path. The feathers of wild-fowl become gummed, and unable to fly, they die of starvation or drown because of exhaustion and the weight of the accumulated material. Their nesting grounds in littoral areas become ruined. Other aquatic and amphibious wildlife is destroyed when the oil closes their breathing apparatus. Recreational areas suffer extensive damage when bathing and boating facilities become fouled.

Although many of these publicized accidents were spills of crude oil, refined oil products are destructive in the same manner only to a lesser degree. Indirect, less noticeable, ecological damage is done by oil slicks covering the water for extended periods of time. The sunlight needed in the photosynthetic process of aquatic plants is masked out. This process releases oxygen into the water as well as producing the sugars used internally by the plants themselves for growth. Thus, not only is the oxygen content of the water reduced but also the amount of plant food for aquatic life is diminished.

Pollution by Sewage

A report in the June 11, 1970 issue of The Greensboro Record points out one of the greatest difficulties which the City of Greensboro has in processing sewage coming into a municipal treatment plant. Water and Sewer Superintendent, Ray Shaw, reported that samplings by city measuring devices indicate that since the first of the year industrial waste volume received and processed in the sanitary sewer system has jumped 21.37 per cent. " 'This problem began last August,' said Shaw, 'and we knew that the overload must be industrial because there is nothing else with capabilities to give that kind of overload.' "

The January through May study of industrial waste, according to Shaw, represents discharges into the sewer system from 19 major industries, 152 restaurants, 80 laundries and 2,000 discharges from septic tank cleaning trucks. " 'This has created a hydraulic (water flow) overload at the plant,' the superintendent explained, 'but we are still operating at about 87 per cent efficiency in the removal of pollutants.' "

Findings of an independent research project undertaken in the summer of 1969 by members of the Biophile Club at Guilford College appear to disagree with efficiency figures previously reported by the personnel of the treatment plant.

Taxing the capacities of treatment plants with wastes from industrial and commercial sources leads to either actual or very possible inadequate treatment of human wastes before effluent is discharged into surface water-courses. Always present is the hazard of processing break-downs under such loads with the subsequent release of totally untreated raw sewage into the stream.

Sewage in water used for domestic purposes such as drinking, cooking and cleaning or for recreational purposes such as swimming, boating, fishing can carry the organisms that cause the "water borne" diseases of cholera, dysentery, hepatitis, and typhoid. This sewage may get into these waters principally by direct dumping of untreated or incompletely treated human excreta and/or by seepage of septic tanks into wells and/or surface impoundments of water and waterways.

Pollution by "Non-toxic Salts"

Materials termed "non-toxic" salts can, at high concentration, be as harmful as poisonous substances. This effect, however, is selective--- it will eliminate many types of animals and plants but will not injure other types of animals and vegetation at all. Presence of salt will make conditions suitable for the encroachment and proliferation of the organisms that are adapted to brackish waters, but uninhabitable for most of the organisms formerly living in the fresh water. The increased salinity will make well water unsuitable for drinking, and water from other sources unfitted for certain industrial processes.

Many of the fertilizers, used abundantly in Guilford County, are salts. Much fertilizer which has been improperly applied leaches from the soil or is carried away by run-off surface water. The effects of these salts upon standing bodies of water into which the surface water drains has not been adequately determined.

Pollution by Herbicides and Pesticides

Herbicides and pesticides are used widely in Guilford County. Many of them are complex organic compounds. For numerous reasons, these materials may qualify as being among our most dangerous environmental pollutants. A list of these reasons is sufficient information to support this judgement and needs little further explanation:

1. These compounds are easy to purchase and to use.
2. In most cases, they are obviously effective (the advertised results can be seen) and the user is satisfied with the product; therefore, he is prone to use them again.

3. These substances are poisons and are toxic even in extremely low concentrations to plant and animal life. However, they are not very selective in what they kill, and pesticides (insecticides) kill the beneficial as well as the harmful insects. For example: bees needed for pollination appear to be quite susceptible.
4. Many of these poisonous compounds are very stable, i.e., they resist degradation, and their effects can last for many years.
5. The direct effects are discernible, but the indirect effects are insidious and difficult to ascertain. Sufficient evidence exists, however, to show that these chemicals become assimilated into the living tissues of animals, including man, by way of the food chain. Effects upon other living organisms can be noted; namely, the physical weakening of species' individuals, shortening of their life span, and failure to reproduce.
6. The effect of these substances, accumulating in the body tissues of man, has not been clearly determined. The major barrier in the way of making this determination is time. Because the regeneration of the human species is relatively slow, an insufficient period of time has elapsed for making comparative studies of physiological responses to these chemicals preceding and following their wide use. Because immediate effects upon humans cannot be observed, reasoned warnings about their danger to human health and survival are only casually considered or completely ignored by the public.
7. There is evidence that harmful insects can build up immunities to these toxins. This stimulates activities of commercial enterprises to synthesize still other such compounds, adding still more such pollution to the environment.
8. After use of these biocides, the population of life communities is changed. It is not the same as the one before the use; there is no guarantee that it will not be detrimental to human existence.

Pollution by Textile Dye Wastes

Pollution of the surface waters of Guilford County by waste dye products is readily observable. With the exception of the pollution of water by soil particles which "muddy" the water, pollution by dye-stuffs is the most strikingly visible contamination in the County. Generally it colors the water some shade of an unnatural blue.

Water used to remove excess dye from cloth is released into both North and South Buffalo Creeks. These tributaries of Buffalo Creek, which also becomes blue, meander for considerable distance across the County. This also attracts additional attention to this type of pollution.

Dyes are considered to be organic chemicals, most of which, today, are synthesized (man-made) products. The dyes are known by various names, many of which indicate the source of the chemical and/or hint at its manufacturing process. Three widely used groups of dyes are known as "coal-tar" dyes,

"aniline" dyes, and "azo" dyes. Because of the differences of the reactions of the basic fibre of the cloth in taking and holding "fast" these chemical dyes, different dyeing processes must accordingly be used. "Union colors" are a special class of azo dyes which readily hold to cotton, wool, and silk; consequently these are the dyes usually sold for household use.

Other "vat" or "mordant" dyes are derivatives of the more complex chemical compound, anthraquinone. These terms refer to the processes followed in using these dyes.

The history of the chemical dye industry shows that Germany was far advanced ahead of other countries, particularly to the time of the advent of World War II, in the discovery and production of synthesized dyes. The German chemists continue to make new discoveries.

Latest treatment for dye wastes has been developed by Friedrich Krupp of Essen, West Germany. A wet catalysis process, called the Kattox process, reduces the organic content of effluent by nearly 90%, and cyanide nitrite and other poisonous contaminants are eliminated. The most heavily contaminated water can be processed in about four hours as compared to biological treatment which requires several days.

The effects of dye pollution is both direct and indirect. Directly, it is offensive to human sensibilities. Indirectly it interferes with aquatic plant growth by reducing the amount of sunlight needed in the photosynthetic process of water plants. These plants contribute both oxygen to the water and food for aquatic animals. This is another example of the disruption of a natural ecological relationship the results of which, due to the lack of systematic research, are known principally by indirect evidence from analogous conditions of pollution.

Deficiencies in Water Pollution Control Legislation

North Carolina has statutes which pertain to the pollution of water in Guilford County. We have examined in detail these laws, and it becomes immediately obvious that because the wording of the laws does not specifically define different types or classes of pollutants, a critical reality of the relative hazards of different types and respective strengths of polluting agents is overlooked. Terms like "sewage" used in describing polluting material is outdated when industrial wastes and human excreta may flow from the same outlet. The language is innocuous and the laws become ineffective toward achieving the purposes, safeguarding human health, for which they were drawn and passed. To illustrate this point, discharges containing mercury, say, are more hazardous to human health than discharges from dairy processing plants. Yet, if they flowed together along with domestic waste through a municipal sewage system, they would be put into the same classification as "sewage". Penalties levied upon polluters should fit the attendant hazards of their pollution.

The following statements refer to portions of the General Statutes selected to illustrate other shortcomings in the legal requirements to regulate pollution of water.

G. S. 130-165 prohibits the discharge of waste into a body of water from which a public drinking supply is subsequently taken unless the waste had been previously treated by a system approved by the State Board of Health and Board of Water and Air Resources. It also states that the continued flow and discharge of such sewage "may be enjoined." The case of Smithfield vs. Raleigh (207 N.C. 597, 178 S.E. 114 (1935)) showed that injunction relief may not always be obtained. The court denied an injunction that would have stopped Raleigh from discharging raw sewage into the tributaries of the Neuse River from which Smithfield obtained its municipal water. This injunction was sought because Raleigh had ignored a State Board of Health order to treat its sewage. The judge denied the relief on the grounds that Raleigh was in financial distress and that there was no evidence that Smithfield's citizens were injured. He did state, however, that Raleigh must not delay unreasonably in complying with the law. In 1948, Smithfield again filed suit, and Raleigh was ordered to reduce pollution by 1956. This is over 22 years from the time the State Board of Health ordered Raleigh to construct a treatment plant.

G.S. 143-215.2 deals with abatement of existing pollution, and sets up the procedures for requiring compliance with special orders of the Board of Water and Air Resources. The Board can issue special orders to any person responsible for polluting air or water within a watershed or area for which quality or emission control standards have been established. In order to alleviate or eliminate pollution, these orders may direct such a person to perform or not perform certain actions, or to achieve specific results within time limits set by the Board. However, "no such special order shall be issued against a person, or if issued, the time for compliance...shall be extended to the extent necessary, where the Board concludes...that it is impossible or, for the time being, not feasible for such a person to correct or eliminate the activities causing or contributing to any such action." Such a situation can be one, according to the statute, when:

1. No adequate or practical treatment or control for the waste is known.
2. The cost of correction is unduly burdensome compared to the results obtained.
3. A known method cannot be adopted because of financial distress.
4. Adoption of presently known methods should be postponed because research may find more efficient methods.

The language of this section of the State law immediately raises the questions:

1. If it is impossible to correct or eliminate the activities leading to pollution, why are these activities permitted to continue?
2. What is the exact length of time to which the phrase, "for the time being" refers before a polluter must comply to correct or

eliminate the activities causing or contributing to any such pollution?

3. How long must people suffer from the effects of pollution with no relief in sight? Who pays for the direct and indirect damage to the environment and to human health in the interim?

G.S. 143-215.15 sets up procedures for and regulates the issuance of permits for water use within capacity use areas. However, "the Board shall have the power...to grant any temporary permit for such a period of time as the Board shall specify where conditions make such temporary permit essential, even though the action allowed by such permit may not be consistent with the Board's regulations applicable to such capacity use area."

The discretionary power given to the Board in the issuance of temporary permits to any party to withdraw water from a capacity use area permits arbitrary action that needs more complete explanation. The term, "where conditions make such temporary permit essential," needs to be more clearly defined; the "conditions" need to be explicitly stated. Are there any checks on the possible abuse of the arbitrary power given to the Board; how easy is it to get a temporary permit? What recourse does a private citizen have when withdrawals of water under a temporary permit by another party cause permanent damage to his well water supply? Are the interests of small water users sufficiently protected from the excesses of large water users?

G.S. 143-215.6 provides for penalties for violations---these are set amounts from \$100.00 to \$1000.00 for each violation. In cases of wilful violations each day during which violation occurs may be considered a separate violation. However, this does not apply to elected or "duly authorized appointed officials or employees of...municipality or political subdivisions" if the voters turned down a referendum that would have provided the means or machinery to prevent these violation from occurring.

In this section of the law dealing with penalties exacted against violators, the very important key words upon which the intent of the section hinges are "wilful violations". The ways of determining "wilful violations" should be spelled out in detail. Citizens should know how a law-breaker is wilfully violating the law so that they may take appropriate action against him.

Why should the municipality or political subdivision not be penalized for their violations; if duly authorized appointed officials or employees of these governmental entities cannot be penalized (where voters have denied necessary funds for corrective actions), legal means should be established to penalize the political entity as a whole.

PHYSICAL POLLUTION OF THE SURFACE WATERS OF GUILFORD COUNTY

Physical pollutants of the waterways and of the surface waters of Guilford County take two forms. One form is by materials which might be termed trash, or junk, or rubbish. This material includes such discarded items as worn-out automobile tires and parts, glass bottles, tin and aluminum cans, broken furniture and toys, rolls of used wire fence, worn-out household appliances of all kinds, etc. Water-courses adjacent to little-travelled County roads, especially, are used as depositories for this junk. This irresponsible practice prevails throughout the County.

The principal effects of this material is direct. It is esthetically displeasing, human beings may receive infectious wounds from it, farm animals may be hurt by it (they may die from ingesting this material), it may block the flow of water to cause local flooding to ruin fordings for farm equipment, and so forth.

Persons dumping this material are subject to anti-litter laws. Recommendations to remedy this type of physical pollution would be those that apply to littering and dumping generally, not only in the waterways.

Perhaps more far-reaching and serious physical pollution of surface waters in Guilford County is that by solids of a different form. From one viewpoint, this is the more harmful pollution because it is more persistent and wider spread, and, although not readily observable by the lay citizens, its cumulative effect bears adversely upon the welfare of a great proportion of the population.

This is pollution by soil particles of various sizes, mainly particles ranging from coarse sand to clay dimensions...larger to smaller particles as described in technical literature of soil scientists and engineers. The major source of this pollution is from land areas which have been disturbed to be exposed, without vegetative cover, to the pounding of rain-drops of high intensity storms and the ensuing unrestricted wash of surface water over these barren areas.

The average citizen has become "accustomed to" or "expects" that the waters of streams and rivers and bodies of water be brown and murky following heavy rains. To this degree, he observes but does not see the pollution by soil material. Unless he understands what he observes and knows where to look---at the junctures of streams and the bodies of water into which they flow---the lay person will not perceive one major effect of this pollution. Simply stated, he will not comprehend that soil pollution builds up the floors of reservoir basins to reduce the capacity of the basins to hold water. In a region, such as Guilford County, where the bulk of the annual amounts of precipitation comes in the form of rain, this process is rapid. The rate of siltation of the reservoirs (and other natural bodies of water) is accelerated markedly under these climatic conditions when a large cumulative amount of the watershed is disturbed by any and all types of operations that strip the vegetative cover and expose the soil surface.

The significance of this type of physical pollution of water to the welfare of Guilford County citizens is obvious. When a given quantity of water is needed by the population, and the capacities of reservoirs constructed to hold this amount of water are decreased, costly remedies to correct this situation must be taken. If soil erosion upon the watersheds is not controlled, the options to insuring the needed supply of water are: (1) dredging existing reservoirs

(2) construction of new reservoirs if proper sites are available (3) long-distance transportation of water from other sources (4) drilling for and using deep well water if available (5) any combination of the above four options. Even when critical stages of siltation are not reached, much additional treatment of raw water is required to filter the water to meet requirements for domestic use.

Other undesirable effects result from accelerated land erosion and increased soil pollution of the water. Drainage of flood water back into stream and river courses is impeded by natural levees of accumulated soil sediment which build up along the shoulders of the channels. Agricultural pursuits are hampered, crops are drowned, or, if the flood-plains are used for parks and picnic grounds, the tables, fireplaces, play equipment, and access roads are rendered unusable for extended periods of time. Further, biologists are concerned about the destruction to the spawning beds and pools for fish life. These beds become silted over and an adequate depth of water is reduced by filling. Other ecological processes are disrupted when aquatic plants suffer from reduction of sunlight reaching them as well as direct physical injury to them.

All water-courses in Guilford County are subjected to this form of physical pollution, particularly those passing through or formed in urbanized areas; the bodies of water they supply are also, consequently, affected.

Legal Requirements

North Carolina Statutory Restrictions:

There are no State laws requiring treatment of land disturbed by surface mining operations to eliminate soil pollution of water from these sources.

There are no State laws requiring adequate measures to retard heavy erosion of and sedimentation from areas exposed DURING the construction of large industrial plants, institutions, shopping centers, residential developments, and roads and highways.

County Ordinances Specifications:

The Guilford County Zoning Ordinance imposes some requirements of a general nature upon the operations of NEW quarries, gravel, sand, and clay pits to control soil pollution of water and resultant sedimentation. The pertinent information of the Zoning Ordinance is more clearly presented in outline:

OPERATION OF QUARRIES

Refer to: Section 5-8 "M-2 Industrial District"
Vegetative controls required: NONE

Refer to: Section 3-15 "Regulations Governing the Operation of Quarries"
Vegetative controls required: NONE

Refer to: Section 5-8 "M-2 Industrial District"
Drainage controls required: NONE

Refer to: Section 3-15 "D. Rehabilitation"
Drainage controls required:

"The channelization of drainage at quarry sites shall be designed and controlled so as not to cause erosion or silting of neighboring properties or public ways, not to appreciably increase the tur-

(continued)

bidity of any natural water-course or to occlude any existing drainage course."

Refer to: "Approving Official"

Approval for opening NEW quarries or gravel, sand, and clay pits in Guilford County is decided by a board of five (5) members, with two (2) alternates, following public hearings concerning these intended uses. These members are appointed by the Guilford County Board of County Commissioners and are presently lay persons from throughout the County who are not specifically trained in the various disciplines of the environmental sciences, nor are now presently engaged in full-time work in any phase of the environmental sciences.

OPERATION OF GRAVEL, SAND, AND CLAY PITS

Refer to: Section 5-8 "M-2 Industrial District"

Vegetative controls required: NONE

Refer to: Section 3-16 "C. Rehabilitation: Item (2)"

Vegetative controls required:

"Except in a case where redevelopment for another permitted use is in progress on the site of an abandoned extractive operation, all excavations shall be graded to reduce the surface to gently-rolling topography in substantial conformity to the land area immediately surrounding, shall be covered with soil of a type which will support the growth of vegetation, and shall be planted with a cover of sod, trees, shrubs, legumes, or grasses, which will minimize erosion due to wind or rainfall."

Refer to: Section 5-8 "M-2 Industrial District"

Drainage controls required: NONE

Refer to: Section 3-16 "C. Rehabilitation: Item (3)"

Drainage controls required:

"The site shall be drained to prevent the accumulation of standing water; and channelization of the drainage shall be designed and controlled so as not to cause erosion or silting of neighboring properties or public ways, nor to appreciably increase the turbidity of any natural water course, or to occlude any existing drainage course."

There are not any County laws requiring adequate measures to retard heavy erosion of and sedimentation from areas exposed DURING the construction of large industrial plants, institutions, shopping centers, residential developments, roads and highways.

Governmental Services

The North Carolina Department of Water and Air Resources is doing a better job than is being done in adjoining states, but shortages of funds and trained personnel is a handicap to cooperative efforts between Federal, State, and County agencies to acquire Federal funds for water projects for which the County would qualify.

The United States Soil Conservation Service is the major governmental agency whose efforts have been directed to conserving soil and water. This agency of the United States Department of Agriculture, however, is not empowered to enforce by legal means the practices and measures they recommend to reduce soil erosion. Historically, as a division of the U.S. Department of Agriculture, the Soil Conservation Service has been oriented to working with people in the rural areas. The major thrust of the efforts of the S.C.S. technicians has been to conserve the soil and water of the farmlands. Increased construction attendant to burgeoning urbanization, however, has sharpened their concerns over the damage to the environment coming from this direction. Their tested skills and knowledge apply equally as well in alleviating soil erosion and water pollution emanating from disturbances of the land for urban-industrial purposes.

There are two major limitations, related to each other, which restrict the activities of S.C.S. personnel from meeting the massive soil pollution problem effectively on a broad front. Agency policies permit the technicians to supply assistance only to those parties who request it; and all taxpayers are treated with impartiality.

General Findings

1. Sources of pollution of water by soil material are (1) agricultural land (2) highway construction (3) surface mining sites (4) real-estate developments, and institutional and industrial building sites.

By following recommendations of the Soil Conservation Service using strip-cropping, sod-planting, winter cover, terracing and vegetated water-ways, and growing either pasture grasses or trees upon steep land, farmers are reducing the amount of soil loss. However, there is need for continued improvement in the protection of farm land from erosion.

The North Carolina Highway Engineers are making noticeable progress in preventing erosion during and following construction upon major projects, but there are still numerous areas on secondary roads with raw clay exposed to erosion. Continued improvement is needed.

The removal of vegetation and topsoil from large acreages invites severe land erosion. These sites are some of our largest contributors to soil pollution of water. The U.S. Geological Survey estimates land erosion from unprotected urban developments is TEN times that from cultivated land, TWO HUNDRED times greater than from grassed areas, TWO THOUSAND times greater than from forested areas (U.S.G.S. WS Paper 1591-E).

2. Presently there are no legal controls, State or County, compelling parties who scalp and open up large areas of soil to protect the surface by vegetative cover and runoff water control and/or reduce soil pollution of water with temporary catch-basins or settling ponds established in the vicinity of operations downstream from them.
3. There is no surface mining law regulating this source of pollution from ESTABLISHED quarries, gravel, sand, and clay pits; there are no legal requirements to be followed by developers and contractors to correct this same problem which occurs DURING the construction of roads, buildings, bridges, culverts, storm drains, curbs, and other installations.

4. The overwhelming amount of land erosion and consequent sedimentation of streams occurs while construction of land use facilities is taking place. Plans and designs submitted for approval as required by the Guilford County Zoning Ordinance describe and explain the vegetative and drainage characteristics of the grounds of an ESTABLISHED land use facility, i.e., only AFTER it has been completed.
5. The City of Burlington is completing a series of small silt control reservoirs on tributaries of Stony Creek on privately-owned land. These are keeping the water clear. A demonstration project of this kind is under construction at the General Greene Council Boy Scout Camp near Browns Summit in Guilford County. Small upstream reservoirs are being constructed to protect Lake Brooks, the major impoundment of the camp. These reservoirs hold back flood water temporarily and settle out silt before the water enters Lake Brooks. Resource Conservation and Development funds allocated by the U.S. Department of Agriculture are being used to meet the costs of this project.
6. Persons, individually or in committees, who are legally empowered to approve the establishment of land uses which directly or indirectly affect the interests of all citizens, should be highly qualified by training and experience to weigh the technical aspects of land use. These persons must have adequate understanding of environmental relationships upon which to base their decisions. They must be capable of making realistic predictions about future ecological responses to current land uses. They must interpret those responses in terms of human needs and welfare at that future date. Present procedures encoded in the Guilford County Zoning Ordinance and followed by the Guilford County Board of County Commissioners do not insure that qualified persons are appointed to serve in those positions.

Impending Environmental Conditions

NOISE POLLUTION

Together with the growth of industrial development and technology, as the total population continues to increase, there will be an accelerated urban density, producing more and more noise as a significant pollutant of our working, residential, and recreational environment. Thus, both now and in the future, the noise problem constitutes an important issue of public health, safety, and community well-being.

It is the common experience of the layman that noise is undesirable when it interrupts conversations, interferes with sleep, and disturbs quiet enjoyment. This experience is fully confirmed by many scientific studies which indicate not only serious hearing loss from excessive sounds, but also a tendency for noise to result in physical, mental, and emotional disturbances such as headaches, nervousness, and somatic manifestations.

Sound waves are desirable for communication, or for enjoyment, but excessive sound is injurious to health, and may harm property, where the decibel level exceeds stress limits. Sound waves are a form of physical energy the impact of which is recorded by a sound-pressure meter in a logarithmic measure known as decibels, the number "1" representing the minimum audibility or threshold sound discernible by a young adult with good hearing.

Considering the biological limits of the human nervous system, we are exposed to excessive noise. Within the home we find the vacuum cleaner, radio, television, stereo sets, food blenders, and power tools. Outside the home, but invading it, are the roar of jet aircraft, motorcycles, power lawn mowers, trucks, the demolition of buildings, construction work, and street repairs employing the pneumatic drill and jackhammer.

In addition, many industrial workers, such as in textile manufacturing, are exposed to excessive noise, as are office employees affected adversely by the noise from typewriters, data processing computers, and business machines. Other illustrations of noise pollution also include exposure to rush-hour traffic, transistor radios played in public places, the rock music from restaurant juke boxes, and the activities of our local airport.

An increase in air traffic, particularly of the magnitude of the SST with its sonic boom, would be so destructive of the quality of life that its prevention deserves priority.

Legal Requirements and Regulatory Agencies

There are no provisions in the State statutes for the prevention or control of noise pollution. The North Carolina General Laws Chapter 19-2 defines "Nuisances" in reference to vice and says nothing about such nuisances as noise. Not only are there no statutory requirements to safeguard citizens from the hazards of noise pollution, the legislative

intent seems contrary to the public interest. As an instance in point, the North Carolina General Laws Chapter 63 on "Aeronautics" is designed to protect airports from people and property (such as requiring removal of trees from the flight path) rather than to protect people and property from airports.

In the absence of enabling legislation, including preventive and corrective actions by agencies of government, the common law--with its "balancing of interests" test favoring business enterprise--does not provide an adequate remedy for the problem of noise pollution.

Apparently, North Carolina leaves this problem to local city and county ordinances to protect citizens from harm, or for the aggrieved individual to bring a private law suit against that person, activity, or company accused of creating a noise nuisance, the penalty being an injunction or an action to recover damages for the alleged injury inflicted.

As yet, there are no provisions to require industries, new plants, and machinery to be designed with approved built-in noise controls. Little consideration has been given to such techniques as closely planted evergreen trees and shrubs to serve as a barrier to highway, industrial, and business noise, placing buildings on deflecting angles so as to minimize noise, or for research, investment, and development of rapid rail transit as a substitute for planned airport expansion. Thus far, sources of noise pollution are not subject to special taxation, absolute liability, triple damages, class action suits by any citizen on behalf of the public to abate noise nuisance, or revocation of operating licenses.

North Carolina statutes do not apply Workmen's Compensation to cover occupational loss of hearing, there are no effective zoning or well-developed acoustical protections in building codes, and no noise-abatement screening or muffling requirements on noise-generating activities such as motorcycles, power lawn mowers, and as to construction and demolition permits.

Impending Environmental Conditions

POLLUTION BY RADIOACTIVITY

Natural radiation to which all living organisms in Guilford County have been and are being exposed is harmless. This is a part of the environment to which all organisms have adapted. It is a natural phenomena that does not threaten serious impairment of the physiological composition and processes of living species.

ALL radiation above natural radiation (that is the radiation from man-made radioactive materials) is a dangerous pollutant. Regardless of standards set by the Atomic Energy Commission to measure and define "safe levels" of radioactivity in the environment, the fact remains that any radiation above the amount to which living creatures have become tolerant is pollution.

Because of past open air detonations and accidental releases of radioactivity, Guilford County citizens and their companion creatures are being subjected to pollution by radioactivity.

To cite the effects of radiation upon the anatomy of the human being and all other species of life is to explain why it has the potential of being our most destructive polluting agent.

Terrible as have been the direct effects of nuclear explosion, where thousands have been killed by physical shock, suffocation, and radiation burns, the persisting subtle effects of radioactive material spread worldwide poses an even greater threat to total elimination of the human race.

Essentially, exposure of the reproductive organs of all living organisms to radiation (differing only in the degree to which the organisms have been exposed) changes the trait-producing material (chromosomes) in the reproductive cells (sperm and ovum) of these organisms. The results of this change have been shown to be:

1. Sterility of the mating adults
2. Still-birth of offspring
3. Abnormal characteristics in the offspring. Because the evolved traits of "normal" individuals in a species have enabled them to survive in existing environmental condition, the abnormal traits, in many cases, also signify the early death of that individual because it cannot adapt to environmental conditions as they naturally occur.
4. In the event that the unlike qualities of the abnormal offspring are not immediately lethal or lead to an early demise and the individual matures and carries out successful reproduction, "genetic pollution" has occurred. Damaged chromosomes are carried over to the new individual and are thenceforth transmitted, in time, throughout the species. Unfortunate combinations of damaged chromosomes from random matings can result in the production of individuals unlike original species forms and appearances. These different individuals are capable of

(continued)

"breeding true" to produce other individuals like themselves.

The danger of radioactive pollution is heightened by its subtlety. The rays emitted by the radioactive material are invisible; individuals subjected to increasing minute quantities of radioactive pollution will not physically sense it, and they will show no outward change in appearance. On a long term basis, the results of radioactivity may go unrecognized. Some radioactive materials retain their effectiveness for long periods of time...this increases their potential as destructive agents. Radioactivity is not easily controlled, cleansed, or neutralized once in the environment free of control mechanisms; it differs from chemical change in that it is spontaneous, and its rate cannot be altered by any means ordinarily at our disposal.

Special Note

The major concern of the authors of this paper is not so much with the present levels of artificially produced radiation in Guilford County, our surroundings, but rather with the potential hazards of this type of pollution.

Plans announced by commercial power companies to install new facilities to generate electricity using radioactive material as a source of power should be a serious concern of all human inhabitants wherever they live regardless of political boundaries. Every new reactor that is established increases the potential for radioactive pollution. The universal nature of most pollution is best exemplified by radioactive pollution because of the relative ease and speed radioactive substances can be carried and spread by air, water, and migrating organisms which have ingested it.

The feasibility of establishing commercial nuclear powered generating stations from the standpoint of the general welfare should be very carefully examined. Rigid safety measures and strict inspection procedures to prevent leaks and vents of radioactive material should be double insured. Disposal of radioactive waste material should be thoroughly studied, planned, controlled, and monitored.

Impending Environmental Conditions

THERMAL POLLUTION

Thermal pollution may be simply defined as the accumulation of unwanted heat energy in the environment. This accumulation may occur in either air or water; as it is rapidly dissipated in air it seldom presents a serious problem. Excess heat in water, however, can result in notable biological effects.

Very few organisms are capable of living at temperatures high than 50 degrees Centigrade (122 degrees Fahrenheit) and most higher organisms are not found actively living above 35 degrees Centigrade (95 degrees Fahrenheit). Fish of any kind are rare above 30 degrees Centigrade (86 degrees Fahrenheit) although carp, goldfish and catfish may barely manage to survive. Largemouth bass can survive and grow at 32 degrees Centigrade (90 degrees Fahrenheit) but do not reproduce above approximately 24 degrees Centigrade (75 degrees Fahrenheit).

One reason for reduced fish survival at increased temperatures is that diatoms, which are important ingredients in the web of food supplies, start to decline in numbers and kinds above 20 degrees Centigrade (68 degrees Fahrenheit) and are replaced by blue-green algae. Blue-green algae are not useful as food sources, are often toxic, undergo frequent "blooms" which choke out other vegetation, and make the water unsuitable for home or industrial use.

Increasing the temperature of water decreases the solubility of gases such as oxygen. Oxygen solubility is decreased over 17% when the temperature is elevated from 20 degrees Centigrade to 30 degrees Centigrade while at the same time the metabolic need for oxygen by fish and other aquatic organisms is doubled. The decay of organic matter and other oxidative processes (such as the rusting of iron) are also accelerated as the temperature increases, further depleting the low supplies of dissolved oxygen.

Salts, however, are more soluble as temperatures increase and may be further concentrated by increased rates of evaporation. Toxins, parasites and diseases are likely to have greater effects at higher temperatures than at more "normal" temperatures.

It is a safe generalization to say that all the worst problems of water pollution are intensified when they are coupled with an increased water temperature.

Heating of surface waters to undesirable temperatures is a result of a number of natural factors interacting with themselves and with factors induced by man. This process stands as a good example of how ecological imbalances are started and become self-generating.

Streams and river gradients of older geological areas, such as the Piedmont region, are relatively low. This means that streams flow at a relatively low rate, water-courses meander, and broad flood plains are formed. Introduction of heavy additions of sediment from areas disturbed by man builds up stream and river channel floors to reduce the depth of the water and diverts water flow to increase the over-all surface

area of the water. Thus not only is more of the mass of the water of the shallower, broader streams subjected to sunlight and heating, but also there is greater total evaporation from extensive surfaces during periods of drouth. Sediment pollution reinforces an existing natural condition of the landscape, and the drainage patter of that landscape, to start a deleterious heating process that becomes progressively worse.

Because of the numerous slow-current streams in Guilford County, all of them subjected to physical, chemical, and biological pollution to varying degrees of severity, it is difficult to say how often high temperature water is encountered in the area. Many of our waterways are intermittent - they dry in the hottest months of summer and fall.

The only local watercourse threatened by thermal pollution is an intermittent stream near Belew's Creek in the northwest corner of Guilford County. Here Duke Power Company plans to erect a dam to impound a lake of some 4,000 acres. The lake will be used as a source of cooling water for a proposed nuclear power generating station producing electricity. Used cooling water is supposed to be returned to the head (upper reaches) of the lake at approximately 102-105 degrees Fahrenheit. It is said that water flowing past the dam will not exceed the legall-imposed temperature limits.

Legal Requirements and Regulatory Agencies

The U. S. Department of the Interior has a standard that no industry may heat stream waters used for cooling purposes above 90 degrees Fahrenheit (32 degrees Centigrade). The North Carolina State Board of Water and Air Resources (a division of the Department of Conservation and Development) has been fighting for a limit of 95 degrees Fahrenheit (35 degrees Centigrade). In a newspaper report (Greensboro Daily News, April 29, 1970), Verne Stevens, Chairman of the North Carolina Board of of Water and Air Resources, recommended that North Carolina would probably accede to federal standards.

A Personal Commentary

James Applewhite is a poet, writer, teacher, and a resident of Greensboro. Professor Applewhite's commentary is a personal expression which, while supporting the more apparent corrective measures proposed elsewhere in this paper, explores more perceptually the underlying causes of environmental degradation.

ECOLOGICAL AND HUMAN VALUES IN GUILFORD COUNTY

America, we are frequently told, is the land of plenty. I question in what sense this is true. Measured by the gross national product or the consumption of resources, ours does seem a land of wealth. But I wonder whether, in the things which constitute the true wealth of a nation in the area other than natural resources, we are not relatively impoverished, have not, in fact, been thus impoverished from the beginning of our history. I wonder whether the denial of this fact to ourselves through the gilded fantasy of American life perpetuated through advertising does not account for a large part of our lack of direction at the present time. Having convinced ourselves that we are rich, how can we address ourselves to our essential poverties?

Perhaps my contention that we are a poor nation seems nonsensical in the light of our moon landings, our inventory of weaponry, the pageants of luxury displayed in our magazines and movies. Let me illustrate my meaning from the circumstances out of which this imagination of America's poverty first came to me.

I was driving, near nightfall, along interstate highway 85 from Durham toward Greensboro, the city in which for eight years I have made my home. The highway was carefully designed and expensively achieved. Many hundreds of thousands of dollars worth of automobile and transport trucks were in view along the four lanes down the long incline, among the partially wooded fields and areas of pasture. Our progress was matched, half a mile to the south, by the mechanical stride of power-line towers. Then I was off the interstate and entering the city along highway 6. Soon I passed over a small river named Buffalo Creek, a stream whose waters are the color of a solution of lead and as incapable of sustaining life. Had it been summer, a sulfurous stench, a mingled odor of fecal rot and chemical poison, would have enveloped the car a hundred yards on each side of its banks. This creek, still dully reflecting dead saplings through the scum on its face, receives the sewage of the City of Greensboro. More sewage and industrial waste are poured into it than could be assimilated by a river many multiples its volume. There is no North Carolina stream sanitation classification sufficiently low to receive it. Buffalo Creek is in its present condition because, from the city's point

of view, the situation can't be helped. Apparently the city cannot afford to treat its sewage adequately for a stream of such relatively low volume. A new areation basin has been built as a result of protests from residents downstream, protests to the effect that in summer fumes from the creek caused the paint to blacken and peel from their houses. But the new basin is not expected in any sense to restore the health of this creek. The point is that the city's provision for the disposal of its wastes appears always to have been calculated along the lines of the bare minimum expense necessary to get this liquid refuse beyond the incorporated limits, and that given existing tax structures and political situations such provision was all that could be made.

Passing once again through the city's industrial suburbs brought to mind my walks about its downtown streets during the years after I had first moved there. I realized that as of this moment of cumulative experience the objects about me were vibrant with a symbolism which I could now interpret, packed with an expressiveness of what, in the American scheme of things, they essentially meant. I thought of the downtown streets named Washington and Greene, the one named for the national, the other for a local, general and hero. I saw in my mind's eye their three and four story buildings housing cafes, warehouses, barbershops, dry goods stores, ominously dim-lit hotels. They spoke what was, and is, too largely true of the city's public sector as a whole; with painted-over windows and rusting fire escapes, they spelled out the bare raw principle of expediency. They said, "for concerns such as us, penury is the rule." They said, "no more than is absolutely forced from the pocket or the till; let the eye starve, the mind go mad, we represent only cover from rain and the sun." The plaster of those brick walls seemed as parching to the eye as the web-cracked mud of dry streambeds.

I argue, then, that in so far as we have built according to such principles of penury, we are an improverished nation. We have been cannily expedient, saving of expensive space in street widths and building lots. We have been functional in designing our cities' arteries of traffic as concrete trenches or conduits to hurry travellers to their chosen destinations. The journeys themselves, those cumulative monotonous ticks of our lives, have been thrown away as useless, have been regarded as something to get rid of like the sewage of Buffalo Creek. We fail to see in our economic calculation that life is best as a whole, that all streams are part of one landscape, all trips a part of one life. We are afflicted with the illusion that we can permanently divide the pure fountains and artificial gardens of the "nice" and "decent" lives we cultivate in suburbs from the sewer-streams and dumps of rubbish bound up with the harsh, expedient labor of the industrial acres. We are a cleanly nation, habituated to scrubbing and purifying the orderly areas directly related to our lives and flushing

the refuse down some sewer or drain. The trouble is that we fail to recognize the nature of our nature, which forever circles back upon itself. The streams we pollute are needed by someone else for drinking; air containing the gaseous refuse of one factory is breathed by the people of the adjacent county. In the future we are going to be less and less able to compartmentalize between the "saved" areas and the "damned" areas of our landscapes and of our lives.

As I drove toward home along Lee Street, looking through lead-colored automobile exhaust at those brick walls and concrete stanchions, I was moved to remember the metaphysics of John Locke--the same John Locke whose influence on Jefferson is responsible for our constitution's assertion that all men are created equal. It was Locke's belief that the qualities of the physical world could be divided into those which are objectively real and those which are subjective illusions only. What he called geometrical figure and extension, volume, solidity and weight--which we today would term mass--these qualities susceptible of exact measurement and mathematical formulation Locke regarded as real, and as comprising the "material substratum" of our world of experience. Qualities of scent, texture, color and sound, like the sensations of warmth and cold and of pleasure and pain, he took to be wholly dependent upon the mind and sensory apparatus of the person perceiving them and thus deserving only the status of subjective sensations.

Through some macabre sequence of events we seem to have founded the public sector of our nation upon a physical structure intended to be as neuter and colorless in affective valuation as John Locke's leaden world of "material substratum." We have built our cities, too often in the past, according to an economy which refused to recognize that the sensations and emotions must have a way to take hold of their environment. It was one thing, in creating an abstract model of the relation between the mind and reality, to relegate those aspects of experience most closely bound up with emotion to a secondary position. But in practice no such separation between levels of reality is possible, and the eye will respond to its surroundings whether the builders of those surroundings intended a response or not. Looking at much of the downtown of Greensboro, I am forced to conclude that the builders of these oblongs of concrete and brick intended their handiwork should say to the eye, "I am neutral, I am for practical considerations only." They did not realize that the emotions will accept no such statement, that they will read instead, "I am willfully ugly, I am here to demean your spirit."

I do not mean to argue that the builders of a city must necessarily be aiming, like the builders of the great civilizations of the past, at a material representation of the glory of their gods, or of God, or of the human spirit, in order to avoid giving the impression of intentional ugliness. But they must at least care for considerations other than the pure expediences of structure and shelter. The building must be motivated by something other than the quick reach for profits if it is to contribute to the genuine wealth of our city and nation; it must be well done for its own sake, as efficiently achieved as possible in its own frame of reference. Beauty of physical surroundings extended to the public along with the services and goods which are housed therein is like love extended to the child with his meal: love and beauty foster growth and response.

There are beautiful buildings in our city. The severity of the Wachovia building is impressive. I like the public library, and the Federal Home Loan building on North Elm Street is unusually pleasing to the eye. There are many other buildings which are at least inoffensive. But unfortunately the dominant impression of the business part of our city is of an inefficient pragmatism of profit-seeking--I say inefficient because with all the clutter of signs along Market and Elm, with all the window displays and illuminated trade names, our central city is losing the sales competition with centers in the suburbs. This is so, in simplest terms, because the natural landscape is still our greatest resource for pleasing the eye and soothing the emotions, a capital of beauty which we are every day improvidently drawing upon. Shopping centers, for all their inadequacy of design, are close to the green trees, pure air and far hills which all we Americans unconsciously love and which we are every day blindly, unwittingly despoiling.

Whether the connection between our profit-seeking industrial society and the metaphysic of Locke is accidental or in some strange way one of effect and cause, the analogy nevertheless holds, and helps to explain why our nation continues to perpetuate its poverty in the midst of plenty. Our nation is dominated by a tenor of mind resembling the metaphysic of Locke, an unvoiced, perhaps unformulated assumption that only those aspects of life concerned with making money or reshaping the earth or building bridges or unloading cargo partake of primary reality. We have allowed ourselves to be convinced in time of want that the dollar is the only important standard, and now in a time of relative prosperity we have not been able to escape that dollar standard to realize our poverties and our genuine wealths. The air, water and landscape which are the basis of all real wealth of life-quality are literally being consumed by the momentum of our commercial-industrial machine.

For Locke only the quantitatively measurable aspects of reality had objective existence. Likewise our culture reserves its central respect for the figures detailing tonnages of cargos, units of production, fluctuations in the gross national product. We are a nation fascinated by the figures of mass, power, and swiftness. We are going to build an SST. We worship horsepower and cubic inches of engine displacement, the weights and speeds of halfbacks, the heights of buildings, the bust-measurements of starlets, the mach ratings of jets, the muzzle velocities of magnum cartridges. Our attention and affection thus focused on quantitative measures, we are poorly equipped for dealing with questions of quality. Just as Locke's thought implied that questions of weight or volume were somehow more primary than variations in color or scent, so we seem to believe that the essential issues of a society are questions of facts and figures, and that determinations of values are simple and somehow will decide themselves. Our ecological crisis suggests that this outlook is ultimately ruinous. Whatever the numbers of people served, or the units of production made possible, by the refuse flowing into Buffalo Creek, the price is not worth the outrage for those living along its banks. Scent is sometimes more real than units of production. In a decade which landed men on the moon, we find it impossible to restore the sanitation of Buffalo Creek; having developed our economic machine to the point from which we can declare that the elimination of poverty is possible in our land, we have lost the definition of poverty, and are unable to conceive true wealth.

The street I was following into Greensboro and nightfall led me eventually to an intersection where, stopped at a red light some weeks before, I had witnessed the crossing of a teen-aged girl from the look-alike houses on the "wrong side of the tracks" toward the more substantial part of the city. She was at perhaps the high point of her life, organically mature yet unlined, and clad in a coat of blond artificial fur and a much-curled blond wig which harmonized rather poorly with the faintly muddy hue of her complexion. Her legs were short but young, her high-heeled shoes seemed to fit her feet but woodenly, and every detail of her figure, of her uncertain, pained, hard-set face, cried starved, starved! I know what a tragically high total of knowledge, attention, care and love the human psyche demands for its flowering, that she had not received it or anything like it, and that her children and their children most likely would not. Looking down that row of single-story, sallow-faced houses with their bare minimums of yards along a block begun by the abode of, as the sign said, "Mother Margo, Faith Healer," I reflected that if as Locke had believed all men are created equal, yet the beginning of inequality must set in instantaneously after birth. The lack of books, of traditions, of sympathetic insight and understanding was reflected in the facades of that pathetic row of houses, representing the human

counterpart of the minimal, soul-debasing area of tin signs, gray concrete, and power poles draped with cables I had passed downtown. The row of houses echoed the cry of the figure of the girl: starved, starved! I do not blame this fact on the present political administration, or on any in the past. I simply record it: in spite of our riches we are an impoverished nation. There is in our land real physical hunger, and there is raging a literal famine of the spirit. Evidence of this famine is no further to seek than the continuing news reports which spell out how completely we have become a society living by drugs. Drug taking on the part of the young is only the most overt expression of our national habit: to attempt each day the purchase of happiness.

The crucial issues which face our city, our county, and by extension our nation at large, might be put forward as two questions. How can we, concerned primarily with the establishment of new industries, the development of ever-more expensive suburbs, respond to the inarticulate cry of the girl with the blond wig? How can we, absorbed in the Greater Greensboro Open, restore to its natural life Buffalo Creek and prevent the green land still left in our county from being chewed away piecemeal by a chaos of mobile home parks, small industries, and strip developments along roadways? To put it another way, the analogy of our commercial, industrialized system to the metaphysic of Locke points up the secondary place accorded aesthetic considerations, and by extension all questions of value, within this system. It is only a primary stress on values which can make us responsive to our outstanding poverties, whether of the spirit or of the landscape. We must learn to ask much more seriously than in the past some very essential questions. We must learn to distinguish the intrinsic goods of clean air, water, and green lands from the "goods" they may be turned into by manufacture. We must inquire as to what good should be sought by society, how it is to be sought, and whether mere growth is in itself a good. We must ask what constitutes true wealth in a nation. Surely it is something more than expansion of the gross national product. Surely true wealth involves well-built cities which enhance man's spirit instead of demeaning it, manufacture which has mastered its own waste, agriculture which preserves the land, planned tracts of wild nature for both knowledge and peace, and a concentration on education for the production of psychic riches, so that man may ultimately master his most venerable foe: himself.

On a level of organization and government, it appears that we need to recognize the necessity of much longer ranged planning, planning of a more unified and scientific sort, than has ever before been thought practical. A recommendation for advisory boards made up partly of

scientists, whose responsibility it will be to evaluate projects affecting the local ecology, is made elsewhere in this paper, and is, I believe an essential step. But planning and advice by itself is not enough. The Guilford County Planning Department has prepared excellent reports on the visual order (or disorder) of Guilford County, and on the diminishing open spaces available to its citizens, together with a coherent plan for the preservation and best use of these spaces. To my knowledge no action has been taken on these reports. It has perhaps not yet seemed needful or practical to implement these proposals.

I believe that if we are to preserve the quality of our lives we are going to have to come up with a new morality and a new definition of what practicality is. As things now stand, a person who smokes a drug which all medical evidence fails to indict as harmful is subject to criminal prosecution; the police and courts push for convictions. Yet it is socially and legally accepted that manufacturers and municipalities may violate anti-pollution laws without serious consequence. I do not condone the use of the drug, but at least its consequences are a private matter, whereas the corporation which dumps mercury into a river is poisoning us all. The bitter absurdity of this hypocritical morality is all too apparent to the young; we are in for a great revulsion against it.

We are, then, going to have to come up with new ideas of what is moral and practical. Traditionally in America the person interested in wild nature for its own sake or whose primary concern was for aesthetic values has been labelled a crank. Now we discover that it is our great American pragmatists of industry and profit who are the madmen among us. We discover that it isn't practical to dump waste mercury into rivers. We discover that it isn't practical to fill deteriorating rockets with nerve gas. We discover that it wasn't practical for Winston-Salem to allow the Schlitz Brewing Co. to begin operations before the city's sewage treatment facility was expanded, at least not from the city of Salisbury's point of view. We have founded our cities and our factories on the impractical assumption that we may be wastefully inefficient toward the ecological background of our lives. Now we begin to realize that in the natural world each organism relates its output of energy and its waste to the arena of its life in such fashion that they be re-cycled for the benefit of all. We discover that it is ultimately impractical for man to dream that he has mastered nature and thus escaped from the imperative that an organism must be efficient in relation to the whole in order to survive. We are after all part of nature and must

emulate its large-scale organization and efficiency. We will in the future be drinking the sewage of Kernersville; we will naturally desire it to be sewage as efficiently cleansed as possible, just as Salisbury desires that effluent flowing into the Yadkin be as clean as it can be made.

Aesthetics, true wealth, and large-scale efficiency of design and execution are interrelated. Impure water offends the nose and the taste, endangers health, and is the result of shallow values and clumsy planning. The ecological and aesthetic salvation of our country is a matter of sound values, intelligence, and efficient planning and execution. The need for intelligence is obvious. The dinosaur may have died for the lack of it, and so could our nation, for all its mass of machinery and power. We must be intelligent enough to see that all amenities and life itself crumble away without air to breathe, water to drink, and green lands to look upon. Large scale planning and review of projects of individual enterprise is necessary to integrate the doings of men into patterns having something of the harmony and appeal of nature. But values are ultimately the most important issue, because upon our values depend our decisions for action. Here I think is where we are most seriously endangered.

Recommendations to Candidates for Elective Offices

Based upon our investigations of environmental conditions in Guilford County, we, as concerned citizens, urge that candidates for elective office study this paper carefully, and, upon being elected to office, work for the immediate implementation of the recommendations presented here.

RECOMMENDATIONS TO CANDIDATES FOR ELECTION TO THE GUILFORD COUNTY BOARD OF COUNTY COMMISSIONERS

Recommendation Number One

We have ascertained that certain deficiencies in established working procedures and inter-agency relationships have hindered governmental units from correcting a broad range of hazardous conditions in Guilford County; consequently, we urge candidates to support and actively work toward establishing the following:

The Guilford County Board of County Commissioners establish, by appointment of members, an extra-governmental, independent board of scientists and other technically trained persons from Guilford County to assist local, State, and Federal agencies of government in reaching their objectives of maintaining a healthful and pleasing environment for the citizens of Guilford County.

We enjoin that the membership of this board be composed of trained and experienced people from a broad spectrum of disciplines covering environmental resource use, physical and psychological health of human beings, and governmental and social transactions and affairs. To this end, we propose that the membership of this board be composed of one person who is highly qualified in each of the following technical fields, respectively, to total nine seats.

<u>Discipline or Technical Field</u>	<u>Seating</u>
Limnology or Hydrology or Meteorology	one
Soil Conservation or Soil Science or Geology or Physical Geography	one
Botany or Horticulture or Forestry or Agronomy or Biology	one
Bacteriology or Microbiology or Pathology	one
Ecology or Sociology or Demography or Psychology or Land Planning or Social Geography	one
Chemistry or Sanitary Engineering or Public Health or Medicine	one
Graphic Arts or Architecture or Community Planning	one
Education or Public Communication	one
Environmental Law or Governmental Administration or Economics	one

As an integral part of this action, we recommend that the Guilford County Board of County Commissioners make a public acknowledgement of this independent board by appropriate title and publicly instruct the board to act in the following capacities:

1. Review the over-all testing procedures followed by the Guilford County Health Department to safeguard the health of Guilford County inhabitants from bacterial, chemical, physical, thermal, radioactivity, and noise pollution of the soil, water, and air of our environment.
2. Collect and compile research data and other information pertaining to residential development, land use, and pollution abatement; and compose and submit appropriate timely reports based upon this information to governmental units for their action and distribute for public

information. An essential part of this activity includes acceptance and consideration of written complaints, criticisms, advice, suggestions, etc., from any citizen about environmental problems and issues.

3. Compose and submit up-dated reports over current environmental conditions in Guilford County making specific proposals to appropriate governmental units for their action and for public information. (The major objective of this activity is to prevent damaging environmental pollution as well as to record the effects of remedial actions taken.)
4. Promote the coordination of activities between local, State, and Federal governmental agencies, educational institutions, and private groups and individuals all working to improve our environment with special emphasis upon establishing coordinated field inspection programs involving Soil Scientists of the U.S. Soil Conservation Service, the Sanitarrians of the Division of Environmental Health, County and City Planners, County and City Engineers, and concerned private individuals and firms.
5. Advise the Guilford County Commissioners and/or the responsible officials of other local governmental units on the suitability of land to be purchased for various kinds of public use.
6. Compose legal drafts or guidelines of procedures recommended for action by the Board of County Commissioners to protect consumer interests in residential buying with special attention given to informing buyers about the qualities of the soil of home sites.
7. Provide for action by the Guilford County Board of County Commissioners and other responsible and appropriate governmental officials legal drafts or guidelines of procedures to alleviate environmental pollution of all kinds. This action would entail proper explanation of the need for the regulations and would include recommendations to revise and/or amend all pertinent laws now in effect.

We recommend and stress that to serve most judiciously the board should maintain an independent status. For this reason, we propose that service on the board be non-compensatory; that membership be voluntarily accepted by citizens appointed to it. However, at the same time, we propose that public funds be approved by the Guilford County Board of County Commissioners to pay the expenses incurred in all activities necessary to fulfill the purposes and designated duties of this board.

Further, to maintain the independence and integrity of the board, the organizational structure and working arrangements should be determined as an internal matter by the members of the initial board. We suggest only that to take advantage of a broad base of expertise in Guilford County as well as to relieve individual members of prolonged voluntary duty, appointments of citizens to be board members be made for staggered terms, three members every two years.

Recommendation Number Two

Including nearby Elon College, there are seven nationally-recognized college/university educational institutions in Guilford County. These institutions are well equipped with laboratory apparatus to perform sophisticated tests and measurements of environmental conditions. As part of their traditional functions, these schools necessarily undertake research programs and are equipped with all of the facilities, including modern data processing devices, to expedite this research. The persons on the faculties of these schools contribute to an extraordinary "talent pool" in scientific fields in Guilford County. Excluding a sizable number of competent persons employed in the smaller training institutions and in the public school system, the approximate number of trained specialists on the staffs of these schools are:

Social Sciences (and related disciplines) 238

Physical, Biological, Earth Sciences (and related disciplines) 138

Findings related to this study of environmental conditions in Guilford County have indicated the following:

1. Private consultant firms have been hired to make various environmental studies in Guilford County and paid with public funds.
2. Personnel from various government agencies not located within the County have been called upon to make studies of local conditions.
3. Samples of various substances have been sent (are being sent) to distant laboratories for analyses to determine their toxicity and possible hazard to human health. Possible hazardous conditions have existed while samples were in transit and the analyses reports were awaited.
4. There are no controlled research projects in Guilford County established to discover means for alleviating pollution of various types.
5. There are no controlled research projects in Guilford County aimed at monitoring various types of pollution. Total Pollution of the County by all types of dangerous contaminants has not been sufficiently defined due to the lack of a systematic testing program and/or monitoring.
6. The laboratories and other scientific facilities of local educational institutions have not been fully utilized, nor the knowledge and skills of local specialists fully employed in dealing with local pollution problems.
7. Grants available from governmental agencies and private foundations to finance pollution research projects have been overlooked.
8. Government funds allocated to aid in paying the costs of projects to improve the environment have not been applied for.
9. Opportunities for training students in the environmental sciences have been missed.

For the reasons that it is highly inefficient, inconvenient, expensive, and even hazardous to await the findings and determinations of distant technical aid while competent persons and adequate facilities are available to perform the same work in Guilford County, we recommend:

The Guilford County Board of County Commissioners convene a meeting with college/university representatives to explore the feasibility of establishing a shared "liaison office" between governmental departments and local academic institutions. The purpose of this intermediary office would be to gain mutual benefits for governmental units responsible for public health of County inhabitants and for local educational institutions with the ready resources to aid government employees in performing their duties. We conceive that in performing this function the liaison office would act to:

1. obtain government and private grants to finance research directed at reducing the pollution of all types of the environment of Guilford County.
2. obtain government and private grants to share in the costs of improvement and/or the establishment of new community facilities to protect public health and for recreation.
3. expedite laboratory testing of materials submitted by governmental units for analyses.
4. instigate systematic testing procedures by the schools to keep current records of on-going environmental damage---this information to be used by governmental units.
5. enable more efficient utilization of local research facilities and field and laboratory equipment, and fuller employment of the talents of local experts.
6. provide realistic educational experiences for students in the science curricula of the schools.

The scope and intensity of present environmental destruction demand the total efficient utilization of all means to reassert and maintain favorable conditions.

Not only have we been seriously remiss in not making full use of the unique assets our many educational institutions afford us in this critical contest, but also, we have not taken full advantage of the ready services which established governmental agencies offer us.

The pollution of the surface waters of Guilford County by soil particles is especially unpardonable not only because this contamination is so widespread but also because the services of a government agency formed especially to deal with this problem have been available to us for many years. This agency is the U.S. Soil Conservation Service with local Guilford County offices staffed by Soil Scientists and Land Use Specialists.

As a consequence, to get immediate action for **reducing** this intensive pollution, we **make** these recommendations:

Recommendation Number Three

The Guilford County Board of County Commissioners immediately confer with the Guilford Soil and Water Conservation District Supervisors and officials of the United States Soil Conservation Service to enlist their aid in the alleviating pollution of our surface waters by soil material.

To this end, we recommend that the Guilford County Commissioners promote and entertain amendments to Section 3-15 & Section 3-16 of the Guilford County Zoning Ordinance (Sections pertaining to operation of quarries and gravel, sand, and clay pits) to read to the effect that specific plans, designs, measures, and explanations drafted and formulated by qualified personnel of the U.S. Soil Conservation Service to control erosion of and sedimentation from these sites be a requirement for certification of these uses in the designed zones.

Recommendation Number Four

The Guilford County Board of County Commissioners promote and entertain amendments to ALL sections of the Guilford County Zoning Ordinance which pertain to ALL uses which entail denuding vegetation and disturbing the land surfaces in ALL zones designated to read in the sense that plans and designs now required and submitted describing vegetative and drainage characteristics of a completed facility of the use intended ALSO include plans and designs describing appropriate surface cover and drainage control WHILE CONSTRUCTION IS TAKING PLACE before certification of the use is granted.

Further we recommend that these plans and designs both of the vegetative and drainage features of the completed facilities of intended uses and the vegetative and water control measures DURING CONSTRUCTION be approved by qualified personnel of the United States Soil Conservation Service before certification is granted; and that appropriate amendments to this effect be made to the present Zoning Ordinance requirements.

Recommendation Number Five

Because of the rapid growth and extension of residential and industrial construction into areas not served by water and sewer lines in Guilford County, we see that immediate action is needed to insure that present and future supplies of water are maintained at a high degree of quality.

Therefore, we recommend:

The Guilford County Board of County Commissioners very carefully evaluate any and all requested departures from the County Zoning ordinance regulations to permit establishment of industrial plants, institutions, and concentrated housing upon all watersheds not served by sewer and water lines.

To this end, we endorse the "Land Use Plan" formulated by the Guilford County Planning Department, published in 1966, and recommend that Commissioners work toward total implementation of this plan to protect watersheds of future reservoirs.

Stipulation: In the "Land Use Plan" Alamance Creek drainage area is not delineated as a "water-gathering" area to be considered as such in development plans. We recommend that it should so be designated with the same protections as applied to the other water-gathering areas shown.

As an essential part of this recommendation for actions to insure sanitary water supplies, we recommend that the Guilford County Commissioners take whatever actions are appropriate to enable the Guilford County Health Department to establish systematic, timely, tests for bacterial pollution of waters flowing from all sub-watersheds upon which industrial plants, institutions, or concentrated housing (not furnished by city water and sewer utility lines) have been constructed.

Recommendation Number Six

One of the most pressing needs of people in a densely populated area is space for relaxation and recreation in a natural setting. In many parts of the nation acquisition of land for these purposes is difficult. Areas which have a scenic value for many outdoor activities may be located too distantly from population centers for convenient use. Land nearer the urban centers may be physically better for more intensive uses and therefore too costly to acquire.

Guilford County is fortunate in having conveniently located areas which are scenic and whose best use would be for parks and other outdoor recreational activities.

However in fast growing regions, space for these outdoor uses must be reserved in advance of its development for public attendance.

Trends indicated that Guilford County will become increasingly more densely populated. Commercial development and urbanization will accompany this increase in numbers of people. Concerned that land areas best adapted to outdoor activities will be appropriated for private development unsuited to the physical features of the terrain and to the best interest of the public, the authors:

Endorse the proposals and support the recommendations set forth in the Guilford County Planning Board reports "Open Space" and "Open Space and Recreation Implementation Plan," including the proposal for the establishment of a County Conservation and Recreation Board and the concept of "phasing" described in these reports.

We recommend that the Guilford County Board of County Commissioners take all appropriate actions to carry out the recommended procedures of the Planning Board.

Recommendation Number Seven

A report entitled, "The Metropolitan Airport System, A Summary", composed by the Guilford County Planning Department and published in November 1968 calls for five new airports and expansion of existing facilities.

Probably the most serious threat of noise pollution in Guilford County is posed by ever-increasing commercial air traffic, particularly by aircraft of the size and flight characteristics of the SST with its sonic boom. Noise of the magnitude created by aircraft of this type would be so disruptive to the quality of life that its prevention deserves priority consideration.

To understand more thoroughly the inherent danger of aircraft noise as the initial step to formulating legal regulations to control it, we recommend:

The Guilford County Board of County Commissioners immediately initiate action to secure further information, supplementing economic data, about (1) the effects of aircraft noise upon human and animal life in the vicinity of aircraft landing areas, (2) the limits to which commercial aircraft operations may impinge upon the private well-being of citizens, (3) alternative means of providing speedy, dependable, convenient, quieter public transportation of persons traveling for business and private reasons.

We recommend that the Guilford County Commissioners enlist the aid of the following governmental departments to secure this information:

Human and Animal Health and Well-Being

Guilford County Health Department, Divisions of Environmental and Mental Health

North Carolina Board of Health, Environmental Sciences Section

North Carolina State Parks Division

North Carolina State Recreation Commission

North Carolina State Wildlife Resources Commission

North Carolina State Forest Service

North Carolina State University Extension Service

North Carolina Department of Water & Air Resources, Air Pollution Control Division

U. S. Agricultural Research Service, Animal Health Division

U. S. Department of Health, Education and Welfare

U. S. Department of Interior, Division of Wildlife Services

U. S. Public Health Service

United Nations World Health Organization

Planning Information

Greensboro and High Point Planning Departments
 Guilford County Planning Department
 Piedmont Triad Council of Governments
 State Planning and Task Force
 State Division of Community Planning
 State Highway Commission, Advance Planning Department
 U. S. Rural Community Development Service
 U. S. Housing & Urban Development

Transportation Information

State Travel Information Division
 U. S. Interstate Commerce Commission
 U. S. Department of Transportation, Bureau of Public Roads
 Federal Aviation Agency

Whenever North Carolina Legislators and Congressional representatives can furnish aid to secure the services of these agencies of government, we recommend that the Guilford County Board of County Commissioners ask their co-operation to do so.

RECOMMENDATIONS TO CANDIDATES FOR ELECTION TO THE NORTH CAROLINA LEGISLATURE

The recommendations made in this paper are intended to be realistic, calling for specific actions tailored with respect to the jurisdictional limitations of the various public offices, within the capabilities of the candidates to fulfill as office-holders.

The authors are fully aware of an apparent shortcoming in confining our study only to environmental conditions of Guilford County. It is obvious that "environment" cannot be neatly compartmentalized, that the environment of Guilford County cannot be totally protected from the effects of the depredations of our neighbors; or their environment from ours. We comprehend what space photography vividly portrayed---we are part of a closed system---our neighbors are world-wide, using the same water and breathing the same air.

Despite this, we have been concerned with this part of the planet for the reasons that (1) this where we live, these are our immediate surroundings, this is our back-yard, and (2) city and county officials can initiate many direct actions that immediately effect the environment we live in.

Although our local officials are empowered to take many necessary measures toward improving our environment, our investigation has revealed that complementary actions of State Legislators are needed to enhance local direction and control even more. This aid our law-makers can initiate takes four forms: (1) Aid in securing State and Federal funds

to help finance environmental improvement projects and programs, (2) Authoring, sponsoring, or otherwise supporting new legislation necessary for better regulation of resource use, (3) Authoring, sponsoring, or otherwise supporting amendments to present laws modernizing them to be better fitted and more effective in regulating current resource use, (4) Instituting legislative study commissions empowered to act to examine environmental conditions in North Carolina and to review local application of regulations.

Consequently, in the area of helping to secure funds to finance local environmental improvement projects and programs, we recommend:

Recommendation Number Eight

Members of the North Carolina Legislature work closely with the Guilford County Board of County Commissioners to carry out the recommended procedures as stated in the reports of the Guilford County Planning Board and aid them to implement plans for acquiring open space in context with regional and State planning designs. *X*

Recommendation Number Nine

Members of the North Carolina Legislature work cooperatively with the Guilford County Board of County Commissioners and solicit the aid of United States Congressmen to obtain available funds from State and Federal sources to aid in the construction of sediment catchment reservoirs to protect city water supply reservoirs from accelerated siltation.

Recommendation Number Ten

Members of the North Carolina Legislature work with the Guilford County Board of County Commissioners, representatives of higher educational institutions in the County, and/or a "liaison office" established for this purpose in seeking grants from Federal or State sources for the purpose of instituting and financing pollution research, testing, and monitoring programs in the County.

In the area of legislative means to aid better regulation of resource use, we recommend:

Recommendation Number Eleven

Members of the North Carolina Legislature initiate, offer, and support amendments to the General Statutes regulating pollution of the surface waters of the State to change, modify, or add to present language of the law to convey or achieve the following meanings and effects:

1. Redefine the term "sewage" as used in the law to make a clear distinction between sewage emanating from domiciles, principally human organic wastes, and discharges coming from

commercial, industrial, and institutional sources, mainly organic and inorganic chemicals of varying strengths and characteristics.

2. Require monitoring of commercial, industrial, and institutional discharges at the point of ingress of municipal sewage systems to measure all non-human organic wastes according to amounts, per cent of total volume in-put, by specific types, and strengths; monitoring equipment and operation to be financed by the establishments; readings of equipment to be made periodically by County Health Sanitarians or other designated County employees.
3. Exclude all discharged material which retains properties dangerous to human health after being processed in municipal treatment plants.
4. Exact penalties to infringement of water pollution regulations based upon the characteristics, amounts, strengths, and effects of non-treatable waste products put into sewage systems.
5. Extend the requirements of monitoring of discharges to include commercial, industrial, and institutional sources not using municipal sewage lines and treatment facilities.
6. Clearly define and qualify what "willful violations" of water pollution laws are.
7. Establish a means of reparation for environmental damage done while sources using water operate on temporary permits to do so.
8. Establish an entity for municipalities or other political sub-divisions (not holding public employees of treatment facilities responsible) against whom pollution damage suits may be brought.

Recommendation Number Twelve

Members of the North Carolina Legislature author, introduce, sponsor, or otherwise support for passage a bill or bills that:

1. enables local municipalities to charge commercial, industrial, and institutional sources of discharges into public sewage systems special fees scaled to the amounts, types, strengths, per cent of total discharge volume, and cost of treatment of waste products emanating from them.
2. establish a monitoring system at the point of ingress of discharges from commercial, industrial, and institutional sources to make quantitative and qualitative tests and measurements of waste materials put into municipal sewage systems;

monitoring equipment to be paid for by the establishments;
cost of the operation to be paid for by the establishments;
readings of the equipment to be made periodically by County
Health Sanitairians or other authorized employee.

3. Require all commercial, industrial, and institutional enterprises to file periodically a complete statement on waste emissions according to types, characteristics, amounts, per cent of total discharge volume, possible deleterious effects, effective treatment measures of material, and strengths of discharges into all types of sewage disposal systems in the county; these reports to be verified, kept in the office of County Health Departments, and available for public reading.

4. All new establishments of the types mentioned above (item 3) required to do the same before certification to build be given.

Recommendation Number Thirteen

Members of the North Carolina Legislature initiate, promote, encourage, or otherwise support efforts to form a special legislative study commission empowered to act for the purpose of making a statewide evaluation of the effects of industrial development upon community life in North Carolina (by type of industry)balancing economic loss due to environmental damage (air, water, noise, etc.) against economic gain (increased tax revenue, workers income, etc.); this information useful as reference material in future legislative proceedings.

Recommendation Number Fourteen

So that County Commissioners may meet the threat of increasing noise pollution with specific local regulations, we recommend:

Members of the North Carolina Legislature work closely with the Guilford County Board of County Commissioners to supply them with all necessary enabling legislation to permit establishment and enforcement of local ordinances passed for the purpose of protecting the public health and well-being of citizens of Guilford County against damages resulting from noise pollution.

Recommendation Number Fifteen

The urbanization and industrialization processes of recent history have led to the use of mechanical devices and equipment never before experienced. Not only do these instruments and tools make noise themselves, but the processes of the plants producing them are also, to a major degree, noisy. Beyond that still, the construction of the plants entails creation of noise. Noise pollution of the magnitude we are experiencing is a modern phenomena. It is so extensive as well as intensive . . . and becoming more so . . . that enabling

legislation for County regulation is not sufficient; State statutes are also required to cope with this problem. In the light of this, we recommend:

Members of the North Carolina Legislature act to originate or sponsor or otherwise support any single or all noise pollution abatement bills that implicitly or explicitly carry the sense of the following items:

1. That the construction of and operation of noise producing establishments be approved by constituted authority and licensed accordingly; license being based upon certification of the fulfillment of the following requirements:
 - 1.1 decibel limits be observed
 - 1.2 spatial relationships between establishments and existing human habitations be observed
 - 1.3 designs of construction be submitted specifying use of acoustical material in the structure, muffling devices of moving machinery, and vegetative plantings or other external sound-damping barriers around completed structures
 - 1.4 statements be submitted prior to construction of installations declaring expected noise levels from moving production equipment and processes of the plant
2. That continuous inspection or monitoring be made to check observance of decibel limits
3. That infringements of legal requirements may be made in the following ways:
 - 3.1 appropriate fines to violations be levied
 - 3.2 citizens be provided with legal recourse in cases of damage by operations exceeding legal decibel limits including the precepts of "absolute liability," "triple damages," "class action suits," and court injunctions
 - 3.3 revocation of license to operate
4. That special taxation be applied to industries and/or use of machinery or equipment which is unable to partially or completely abate noise within required levels.
5. That certain types of noise producing industries and/or machinery or equipment operation be prohibited
6. That muffling devices be required on all moving mechanical devices outside of plant building walls and grounds; this equipment subject to monitoring to meet decibel limits
7. That employees of plants receive Workman's Compensation for loss of hearing due to occupational causes.

RECOMMENDATIONS TO CANDIDATES FOR ELECTION TO THE UNITED STATES
HOUSE OF REPRESENTATIVES, SIXTH DISTRICT

This study has pointed out how the quality of our local environment is determined by widely distributed influences---soil pollution of water may be caused by uncontrolled wash from a local building project; bacterial pollution of surface water may start in an adjacent county; air pollution may be increased by use of products manufactured in other states.

Recommendations dealing with pollution must, accordingly, be directed to those candidates to public offices which are best fitted by delegated authority and resources to act upon them.

The Federal Government, historically, administers in the areas of interstate affairs, affairs of national concern where Federal agencies can act most expeditiously for citizens' welfare.

Acknowledging that deterioration of the environment is a national calamity, that conditions found in Guilford County are repeated throughout the country, and that Federal aid is necessary to upgrade the quality of ecological conditions under which all American citizens live, we recommend:

Recommendation Number Sixteen

The U.S. Representative, Sixth District, work cooperatively with State and local government officials to keep them currently informed of all opportunities offered by Federal agencies to aid in the improvement of environmental conditions in Guilford County. Local officials should be apprised of the availability of Federal funds and agency services to help in improvement projects. Particular attention should be paid in exploring the use of authorized funds to acquire open space and wilderness land, to improve water and sewage treatment facilities, to establish water research programs.

Recommendation Number Seventeen

The U.S. Representative, Sixth District, encourage his fellow House members to support the air pollution bill offered by Senator Edmund Muskie, passed by the Senate.

Recommendation Number Eighteen

Electric mono-rail facilities capable of rapid transit up to 150 miles-per-hour have been operating successfully in Japan. This mode of travel in Guilford County should be seriously considered to prepare for the predicted increase in population. Rapid transit of this type would permit airports to be located further from population centers without inconvenience to travelers; it would also be a partial solution to transportation problems, generally, tending to reduce highway congestion and construction costs, and minimize environmental pollution by noise and exhaust emissions. Consequently, we recommend:

The U.S. Representative, Sixth District, support all efforts, including research, aimed at establishing rapid transit systems throughout the nation including the Piedmont Crescent complex of which Guilford County is a part.

Recommendation Number Nineteen

The U.S. Representative, Sixth District, intercede to oppose Federal financing (directly or indirectly) of all airport facilities and operations which would increase noise and air pollution of the environment in and around settled communities or wildlife abodes or other special reservations including, in this opposition, efforts to permit supersonic aircraft over-flights of the territory of the United States.

Recommendation Number Twenty

The U.S. Representative, Sixth District, support general legislation to minimize the problem of noise pollution, and particularly those bills that require the administrative agencies of the Federal government, such as the F.A.A., to promulgate rules to reduce noise by making airlines subject to reasonable local noise-abatement ordinances.

Recommendation Number Twenty-one

The U.S. Representative, Sixth District, give support to the establishment of the "Environmental Protection Administration" as recommended by the President's Council on Executive Reorganization; Roy Ash, Chairman.

Postword

The authors and reviewers of this White Paper welcome all inquiries about the content matter published here. We will attempt to answer all questions pertaining to any and all subjects covered in the paper to the best of our individual and collective abilities.

We wish to thank all who made this publication possible.

complimentary

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